Southern LNG
an El Paso company

October 31, 2006

Mr. Jeng-Hon Su
Air Protection Branch
Georgia Environmental Protection Division
4244 International Parkway, Suite 120
Atlanta, GA 30354

RE: Southern LNG, Inc. – Elba Island LNG Terminal (Chatham County)
Title V Permit No. 4922-051-0003-V-02-0
Title V Modification/Prevention of Significant Deterioration Application No. 16697
Vaporizer PM Emissions Documentation; Indirect Emissions Inventory; Air Toxics Modeling Update; Plume Visibility Analysis Update

Dear Mr. Su:

Southern LNG Inc. (Southern LNG), a wholly-owned subsidiary of Southern Natural Gas Company (SNG), owns and operates the Elba Island Liquefied Natural Gas (LNG) Terminal, located on Elba Island near the City of Savannah in Chatham County, Georgia. The Elba Island LNG Terminal is designed to receive shipments of liquefied natural gas from tankers carrying LNG. Once unloaded from the tankers, LNG is stored and subsequently vaporized to natural gas pipeline operating conditions and delivered into various downstream interstate natural gas pipeline systems including SNG. Southern LNG recommissioned LNG import operations in 2001[1] and subsequently obtained approval for an expansion (Elba II Terminal Expansion)[2] to import, storage, and sendout operations that was commissioned in February 2006. The facility currently operates under Title V Permit No. 4922-051-0003-V-02-0 issued by the Georgia Environmental Protection Division (EPD) effective May 5, 2004.

Southern LNG prepared and submitted a Prevention of Significant Deterioration (PSD) construction permit and Title V modification application on April 10, 2006, for a proposed expansion of the Elba Island LNG Terminal (Elba III Terminal Expansion). Because air emissions increases associated with this expansion exceed the PSD significant emission rates for oxides of nitrogen (NO_X) and carbon monoxide (CO), the project is subject to New Source Review for air quality impacts under the PSD program, which specifically requires Best Available Control Technology (BACT) and air quality analyses as administered by the Georgia Environmental Protection Division (EPD) and Georgia's *Rules for Air Quality Control* (GRAQC) (Revised, April 2006).

After EPD's initial review of the Elba III Terminal Expansion permit application, Georgia EPD sent a letter to Southern LNG requesting emissions data from vessels at berth and dispersion modeling that

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[1] Refer to Elba Reactivation Permit No. 4922-051-0003-P-01-0, effective January 24, 2001, for additional information.

[2] Refer to Elba II Expansion Permit No. 4922-051-0003-P-01-3, effective February 17, 2003, for additional information.

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includes activities of vessels at berth.[3] Southern LNG submitted a response to that letter demonstrating that the Elba Island LNG Terminal will not cause or contribute to an exceedance of the National Ambient Air Quality Standards (NAAQS) or PSD Increment following the completion of the Elba III Terminal Expansion project, including secondary emissions from vessels at berth.[4] Georgia EPD also subsequently requested additional information regarding documentation of particulate matter (PM) emissions from the proposed LNG vaporizers,[5] criteria pollutant emission estimates for all vessel activities to update the agency's regional emissions inventory,[6] an updated air toxics modeling analysis that includes secondary emissions from vessels at berth,[7] and an updated plume visibility analysis that includes vessel emissions.[8] Attachment 1 to this letter contains copies of Georgia EPD's multiple requests for additional information.

Southern LNG and Trinity Consultants (Trinity) have prepared this letter to provide Georgia EPD with the requested information. Southern LNG and Trinity noted that Georgia EPD at one time requested "a new CD containing the updated Title V and PSD Permit Application (with the new modeling)"; however, since modeling results are not part of the application and secondary sources are not customarily included as part of the application for a stationary source, the information in the initial Title V and PSD permit application forms and database have not changed. This letter includes documentation from the LNG vaporizer vendor regarding PM emissions, a review of criteria pollutant emissions from vessel activities, an updated air toxics modeling analysis to analyze the impacts attributable to vessels at berth in conjunction with the Elba Island LNG Terminal, and an updated plume visibility analysis. The emission calculation documentation and methodologies, as well as the results of the modeling analyses, are presented as an attachment to this letter. A CD-ROM enclosed with this letter contains electronic copies of input and output files for the additional modeling analyses.

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[3] Refer to letter from Mr. Jeng-Hon Su (EPD) to Mr. James Tangeman (Southern LNG), June 5, 2006.

[4] Refer to letter from Mr. James Tangeman (Southern LNG) to Dr. James Boylan (EPD), September 1, 2006.

[5] Refer to letter from Mr. Jeng-Hon Su (EPD) to Mr. James Tangeman (Southern LNG), September 14, 2006.

[6] Refer to letter from Mr. Jeng-Hon Su (EPD) to Mr. James Tangeman (Southern LNG), September 25, 2006.

[7] Refer to letter from Mr. Jeng-Hon Su (EPD) to Mr. James Tangeman (Southern LNG), September 27, 2006.

[8] Refer to letter from Mr. Jeng-Hon Su (EPD) to Mr. James Tangeman (Southern LNG), October 18, 2006.
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Southern LNG and Trinity appreciate Georgia EPD's commitment to promptly reviewing this supplemental information for the Elba III Terminal Expansion PSD permit application. If you have any questions or comments about the information presented in this response letter, please do not hesitate to call me at (205) 325-7633 or Ryan Gesser of Trinity Consultants at (404) 256-1919.

Sincerely,

James Tangeman
Southern LNG/an El Paso Company
Principal, Eastern Pipelines Group

UPS: 1Z 334 569 01 9801 6213

JGT/bg

Attachments

cc: Mr. James Capp, Georgia EPD
Mr. John Yntema, Georgia EPD
Mr. Ryan Gesser, Trinity Consultants

EXECUTIVE SUMMARY

Southern LNG submits this letter and associated attachments to address all of the outstanding items that EPD has requested since the submittal of the PSD permit application in April 2006 and supplemental NO_X modeling analysis in September 2006.

- Documentation of the appropriate PM emission factor from the SCV vendor
- Complete vessel emissions inventory to update EPD's regional modeling emissions inventory
- Updated toxic air pollutant air quality analysis
- Updated plume visibility analysis

LNG VAPORIZER PARTICULATE MATTER EMISSIONS

The primary stationary sources of air emissions at the Elba Island LNG Terminal are the LNG vaporizers. Prior to delivery into the interstate pipeline system, the LNG must first be vaporized into natural gas, and then pumped at pipeline operating conditions for transmission. Vaporization is achieved as LNG is brought into indirect contact with a heated glycol-water solution. Vaporized natural gas exits the vaporizers and is delivered to a metering station at approximately 35 to 40 °F prior to send out to the interstate pipeline system. Southern LNG currently operates eight submerged combustion vaporizers (SCV). An additional six SCV are proposed as part of the Elba III Terminal Expansion project. LNG SCV is a unique type of indirect-fired heat exchanger with the burner and process tube coil contained in a single vessel. Each LNG SCV consists of a lone burner along with a heat exchanger coil in a water tank. The design is based on the discharge of natural gas combustion products into a water bath which is used as the heat transfer medium for vaporizing the LNG in the tube coil.

Although the SCV are regulated as boilers, the emissions profile is not exactly the same as a traditional natural gas fired external combustion unit. In each of the three permit applications submitted for the Elba Island Terminal since 2000, Southern LNG has estimated NO_X, CO, and volatile organic compound (VOC) emissions based on vendor emission factors from the SCV manufacturer, T-Thermal (a subsidiary of Selas Fluid Processing Corporation). Sulfur dioxide (SO_2) emissions were based on emission factors in Section 1.4, *Natural Gas Combustion,* of AP-42. As SO_2 emissions are primarily related to the sulfur content in the fuel, Southern LNG felt that the traditional boiler emission factor in AP-42 would still be representative of the SCV process. PM emissions were estimated based on T-Thermal's technical assessment that total PM_{10} emissions from submerged combustion are anticipated to be at a level consistent with the AP-42 emission factor for filterable PM_{10} from natural gas combustion in a traditional boiler. Therefore, the emission factor selected to calculate total PM emissions from the vaporizers was 1.9 lb/MMscf, which can be converted to 0.0018 lb/MMBtu, assuming an average natural gas heating value of 1,050 Btu/scf. The selection of this factor is not meant to indicate that all PM emissions from the SCV are filterable PM. Rather, T-Thermal stated that AP-42's filterable emissions estimate is representative of total PM emissions from their SCV process.

Although the vendor did not provide a PM emission guarantee for the vaporizers proposed as part of the Elba III Terminal Expansion project, T-Thermal has conducted PM emissions testing on one of

the five original vaporizers at Elba Island.[9] The results of the testing are consistent with the PM emission factor estimate relied upon in the current and previous permit applications at Elba Island LNG Terminal. Filterable PM emissions during the test were 0.00109 lb/MMBtu, and condensable PM emissions during the test were 0.000405 lb/MMBtu. Based on these results, total PM emissions during the source test were 0.0015 lb/MMBtu, which is approximately 17% lower than the emission factor of 0.0018 lb/MMBtu relied upon to estimate potential emissions for the proposed SCVs for the Elba III Terminal Expansion. A letter from the SCV vendor to Southern LNG documenting these results is provided in Attachment 2 of this submittal.[10]

Southern LNG provides this information to address EPD's concern that the Elba III Terminal Expansion project permit application may not have included the condensable portion of the PM emissions when calculating the total PM emissions from the proposed vaporizers. Based on the vendor documentation, Southern LNG feels that the total PM emissions from the vaporizers should remain unchanged from that proposed in the April 10, 2006 PSD permit application which resulted in the proposed Elba III terminal expansion having potential PM emissions of 6.15 tpy. This emissions increase is less than the PSD significant emission rate of 15 tpy PM_{10}. Therefore, a PM BACT determination and PSD air quality analyses are not required for this project.

[9] PM emissions testing conducted in October 2005 using a sampling train setup according to U.S. EPA Method 5 for filterable PM emissions and U.S. EPA Method 202 for condensable PM emissions.

[10] Refer to letter from Mr. Peter Falcone (Selas Fluid Processing Corporation) to Mr. James Tangeman (Southern LNG), October 17, 2006.

INDIRECT EMISSIONS DUE TO VESSEL ACTIVITIES

Indirect emissions of air pollutants are generated from LNG carrier ships calling at the Elba Island LNG Terminal and from various support vessels. EPD has determined these LNG carriers and support vessels are not part of the stationary source, as the vessels and LNG terminal are not operated under common control.[11] The Georgia *Rules for Air Quality Control* (GRAQC) 391-3-1-.03(9)(c) defines a stationary source as "all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control) except the activities of any vessel," which is consistent with the PSD definition of a stationary source at 40 CFR Part 52.21(b)(6). Since these emissions are not part of the stationary source, Southern LNG has termed these emissions from LNG carriers and support vessels as indirect emissions.

Secondary emissions are a specific subset of these indirect emissions. U.S. EPA air quality regulations for PSD permitting define secondary emissions as follows (40 CFR Part 52.21(b)(18)):

> *Secondary emissions means emissions which would occur as a result of the construction or operation of a major stationary source or major modification, but do not come from the major stationary source or major modification itself. Secondary emissions include emissions from any offsite support facility which would not be constructed or increase its emissions except as a result of the construction or operation of the major stationary source or major modification. Secondary emissions do not include any emissions which come directly from a mobile source, such as emissions from the tailpipe of a motor vehicle, from a train, or from a vessel.*

Although the regulatory definition of secondary emissions excludes emissions from the tailpipe of mobile sources, such as LNG cargo vessels in transit, the emissions from the vessels while at berth are included as secondary emissions based on recent discussions with EPD. Activities conducted while the vessels are at berth include hotelling operations and LNG offloading. Southern LNG addressed the secondary emissions associated with the Elba Island LNG Terminal as part of an updated air quality analysis submitted to EPD on September 1, 2006.

Although not required as part of the PSD permitting and air quality analyses, EPD has requested additional information regarding indirect emissions from the LNG carriers and support vessels to update the agency's regional emissions inventory. In addition to the secondary emissions analysis prepared for EPD, Southern LNG has also prepared a cumulative emissions analysis for review and approval by the Federal Energy Regulatory Commission (FERC) to meet requirements of the National Environmental Policy Act (NEPA). To satisfy the more general NEPA requirements providing an assessment of incremental and cumulative change in emissions associated with the expansion project, the emissions analysis given to FERC provides information about emissions from operations other than those at dockside and for pollutants other than NO_X. Southern LNG submitted this additional emissions analysis to FERC as part of the Resource Report No. 9. Note that the Resource Report No. 9 analysis differs from the scope of the secondary emissions modeling analysis in that the modeling analysis was limited to NO_X emissions from dockside operations since "to and

[11] Refer to letter from Mr. Jeng-Hon Su (EPD) to Mr. James Tangeman (Southern LNG), September 25, 2006.

fro" emissions and mobile source activities are specifically excluded from the definition of secondary emissions, and the modeling analysis is limited to those pollutants for which PSD review is required.

To assist EPD in maintaining an updated regional modeling emissions inventory, Southern LNG presents this quantification of indirect vessel emissions based on all reasonable vessel activity associated with the Elba Island LNG Terminal, including transit or "to and fro" emissions. The nature, size, frequency, and fuel-burning characteristics of LNG carrier ships that call at the Elba Island LNG Terminal are not under Southern LNG's control or regulated for uniformity, but rather are dictated by Southern LNG's customers that utilize LNG carriers from foreign sources. The LNG carrier emissions presented in this analysis are based on vendor specific LNG carrier emission data as provided by Southern LNG customers. Emissions from the tug assist vessels are estimated based on the Tier II IMO/EPA Requirements (effective 2007). U.S. Coast Guard (USCG) escort vessel emissions are based on factors for four-stroke outboard, precontrolled engines, as presented in EPA's "Exhaust Emission Factors for Nonroad Engine Modeling – Spark Ignition." Air emissions from these vessels are quantified using energy-based emission factors along with fuel types. Indirect emissions presented in this analysis include emissions from the LNG carrier while berthed at dockside for LNG offloading operations, emissions from the LNG carrier while in transit, emissions from tug assist vessels, and emissions from USCG escort vessels.

At Elba Island, incoming LNG carriers loiter or anchor offshore until approved to enter the port by the U.S. Coast Guard before proceeding into the Savannah River shipping channel. Once the vessel is authorized to proceed, a summary description of the carrier and accompanying tugs activities is provided below:

- At a point approximately sixteen to eighteen nautical miles from the facility (within two miles outside the sea buoy), one Savannah River Pilot, one Docking Pilot and one tug assist vessel join the ship. To facilitate boarding by the River and Docking Pilot, the ship speed is reduced to approximately ten knots. Once the pilots have boarded, the transit continues at approximately twelve knots. The inbound transit is estimated to take approximately one hour and forty-five minutes. During inbound transit operations LNG cargo ships may burn marine diesel heavy fuel oil (HFO) and/or boil-off LNG fuel gas. Tug assist vessels burn diesel fuel
- At a point approximately six to eight nautical miles from the facility (at the Savannah River jetties), one additional tug assist vessel joins the LNG carrier for escort purposes.
- At a point approximately one to two nautical miles from the facility (approaching the slip entrance), two additional tug assist vessels join the LNG carrier for purposes of docking assistance. A total of four tug assist vessels are now engaged with docking duties. Docking maneuvers take approximately thirty minutes.
- Once the LNG carrier is moored, two tug assist vessels are released, and two tug assist vessels remain moored at the facility for emergency response, if needed. One of the two tug assist vessels typically keeps engines warm in an idle mode. One Docking Pilot remains onboard the vessel throughout the operation. Once the vessel is moored, the propulsion engines are shut off and only auxiliary engines are operational in what is termed "hotelling." During "offloading," engines are used to power pumps to offload LNG into the Elba Island LNG Terminal. Hotelling and offloading operations typically last a period of 20 to 30 hours. LNG carriers burn marine diesel heavy fuel oil (HFO) and/or diesel fuel during hotelling and offloading operations.

- Once the LNG cargo is discharged and the carrier is approved to depart the port by the Savannah River Pilots and U.S. Coast Guard, the Docking Pilot is joined onboard by one Savannah River Pilot for departure. The two tug assist vessels in standby at the facility are joined by two additional tugs to assist the LNG carrier in undocking and departure. A total of four tugs are now engaged with undocking duties. Undocking maneuvers take approximately fifteen to thirty minutes.
- At a point approximately one-half to one nautical mile from the facility two tug assist vessels are released and two remain with the LNG carrier for the outbound escort. A total of two tug assist vessels are now engaged with escort duties. Once the outbound transit is underway, the carrier will proceed at approximately twelve knots slowing at termination for a short time to approximately ten knots to facilitate disembarking the River and Docking Pilots. The outbound transit is estimated to take approximately one hour thirty minutes. During outbound transit operations, LNG carrier ships may burn marine diesel heavy fuel oil (HFO) and/or boil-off LNG fuel gas.
- At a point approximately six to eight nautical miles from the facility (at the Savannah River jetties), one of the escort tug assist vessels is released with one tug remaining with the carrier. A total of one tug assist vessel is now in company of the LNG carrier.
- At a point approximately sixteen nautical miles away from the facility, the Savannah River Pilot and Docking Pilot depart the ship, and the tug assist vessel is released from service.

Supporting documentation including the fuels burned, duration of each activity, and power in each operating mode are included in Attachment 3 to this letter. Occasionally, USCG vessels may escort the LNG carriers to Elba Island and patrol the area while LNG is offloaded to the terminal. For the purpose of this analysis, it was estimated that two escort vessels would accompany each carrier port call, and one vessel would patrol the island during hotelling and offloading operations. The transit emissions from the LNG carriers are an approximation, based on an LNG carrier traveling at 12 knots for two hours while in the reduced speed zone (RSZ), which equates to a distance of 24 nautical miles each way. The transit emissions were estimated out to this distance, because this point is where ships begin entering the Port after they have received approval from the USCG to proceed, and the tugs begin assisting the carriers to enter the Savannah River channel and the Elba Island LNG Terminal.

Southern LNG estimated annual indirect emissions following the Elba III Terminal Expansion based on emission factors provided by Southern LNG's customers, the type of fuel burned, the estimated time required to complete the offloading operation, and the estimated number of annual port calls. Table 1 provides a summary of secondary and indirect emissions at the fully subscribed capacity of Elba I, II, and III. Supporting documentation for the estimated emissions presented below is provided in Attachment 3 to this letter. The documentation includes customer specific emission factors, fuel types, and power load and duration of each operating mode. This information is based on currently available estimates from Southern LNG's customers for the Elba III Terminal Expansion.

TABLE 1. SUMMARY OF INDIRECT AND SECONDARY EMISSIONS FROM VESSEL ACTIVITIES

	Cumulative Vessel Emissions due to Elba I, II, and III				
Operation	**NO_X Emissions** (tpy)	**SO_2 Emissions** (tpy)	**CO Emissions** (tpy)	**PM_{10} Emissions** (tpy)	**VOC Emissions** (tpy)
LNG Carrier Offloading	232	416	12	37	5
LNG Carrier Hotelling	32	47	2	4	0.7
LNG Carrier Transit	38	58	15	6	7
Assist Vessel Standby during Offloading/Hotelling	79	3	4	4	3
Assist Vessel Maneuvering/Pushing/Transit	93	3	7	7	5
Coast Guard Escort Vessels	17	0.4	490	0.1	14
Vessel Emissions at Berth	**343**	**466**	**18**	**45**	**8**
Total Vessel Emissions	492	528	530	58	34

UPDATED AIR TOXICS MODELING ANALYSIS

As part of the PSD permit application submitted in April 2006, Southern LNG prepared a toxics modeling analysis based on emissions from the Elba Island stationary source to demonstrate compliance with the acceptable ambient concentrations (AAC) of 83 potentially toxic air pollutants. EPD has expressed a concern that the air toxics analysis did not include secondary emissions from vessels at berth. To comply with Georgia Air Quality Rule 391-3-1-.02(2)(a)3(ii) and Georgia Toxic Guidelines, in order to safeguard the public health, safety, and welfare of the people of the State of Georgia, Southern LNG has prepared an updated ambient impact assessment of toxic air pollutant emissions, including both the Elba Island LNG Terminal stationary source emissions and secondary vessel emissions. The following sections address the toxic air pollutant emissions quantification methodology, modeling methodology and results. In general, the methodologies utilized in the updated air toxics analysis are consistent with the methodologies used in the April 2006 air quality analyses and the September 2006 supplemental NO_X analysis.

QUANTIFICATION OF TOXIC AIR POLLUTANT EMISSIONS

Toxic air pollutant emissions were quantified using similar methodologies described in the supplemental NO_X analysis submitted in September 2006. Southern LNG did not have access to customer specific toxic air pollutant emission factors. Therefore, toxic emissions were estimated based on AP-42 emission factors and the estimated fuel consumption for each type of vessel. A summary of the resources used to compile the toxic air pollutant emission factors to estimate secondary vessel emissions in provided in Table 2. Supporting documentation including fuel usage, short-term emissions and annual emissions, is provided in Attachment 4 to this letter.

TABLE 2. SUMMARY OF TOXIC AIR POLLUTANT EMISSION FACTOR RESOURCES

Vessel	Emission Factor Source	Table(s)	Fuel
BG Carrier Ship	AP-42, Section 1.3	1.3-8, 1.3-9, 1.3-11	No. 6 Fuel Oil
Shell Carrier, Steam Turbine	AP-42, Section 1.3	1.3-8, 1.3-9, 1.3-11	No. 6 Fuel Oil
Shell Carrier, Med Speed Diesel	AP-42, Section 3.4	3.4-3, 3.4-4	No. 2 Fuel Oil
Tug Assist Vessel	AP-42, Section 3.4	3.4-3, 3.4-4	No. 2 Fuel Oil

As the LNG carriers and tug assist vessels are not offloading and hotelling continuously, Southern LNG estimated short-term and annual emissions to demonstrate compliance with the short-term and annual averaging periods, respectively. For AAC based on averaging periods less than a year, Southern LNG estimated the maximum hourly emissions based on the worst-case fuel. Annual emissions were calculated based on estimated number of port calls for each type of ship provided by Southern LNG's customers, BG and Shell. As the stationary sources at Elba Island do not burn No. 6 fuel oil, the updated toxics analysis includes three additional pollutants that were not analyzed in the April 2006 submittal. The total number of pollutants included in the updated air quality analysis is 86. Please refer to the tables in Attachment 4 to this letter for potential secondary emissions of toxic air pollutants.

DISPERSION MODELING METHODOLOGY

Southern LNG and Trinity previously documented the dispersion modeling methodology used for the Elba Island stationary source in a modeling protocol submitted to Georgia EPD on December 20, 2005, and as part of PSD construction permit and Title V modification application submitted on April 10, 2006. Southern LNG and Trinity also documented the dispersion modeling methodology used for secondary vessel emissions at berth in the September 2006 supplemental NO_X analyses. In general, the same modeling procedures were followed in analyzing the toxic air pollutant impacts due to secondary emissions of vessels at berth along with the Elba Island stationary source. Specifically, Southern LNG and Trinity utilized the same dispersion model (ISC-PRIME), meteorological conditions[12], terrain data, land-use classification (rural), coordinate system (UTM), and Elba Island LNG Terminal emission rates and stack parameters as were used in the modeling analyses submitted with the permit application in April 2006. The secondary emissions source parameters are identical to those submitted in the September 2006 supplemental analyses.

For the updated toxics modeling analysis, Southern LNG and Trinity continued to implement a slight modification to the receptors analyzed. In previous modeling analyses, Southern LNG has determined that the mean low water boundary of Elba Island represents the property line. Southern LNG owns the entirety of Elba Island and limits public access to the island via a single controlled-access road and bridge. Unauthorized public access to Elba Island could only be gained by entering Southern LNG's property from the Savannah River or South Channel. Therefore, the ambient air boundary was determined to be the mean low water line and discrete receptors were modeled around this boundary accordingly. Obviously, vessels berthed at dockside would be outside of this property line. Although Southern LNG does not own the open waters of the Savannah River, nor control access to the offloading area with a permanent structure, U.S. Coast Guard vessels patrol the area and limit access in the berthing area to only those vessels required for safety and operational purposes (LNG carriers and tug assist vessels). Therefore, Southern LNG and Trinity redefined the property line in the area surrounding the offloading area to include the LNG carrier docks and a seventy yard (64 meters) buffer zone beyond the vessels associated with the offloading process.[13] Representative figures depicting this slight modification were provided with the supplemental NO_X analysis in September 2006.

Figure 1 presents a three-dimensional image of the LNG offloading area to assist in visualizing the vessels while at berth. Stack locations are represented by aqua figures. Solid blue objects represent structures, such as buildings, storage tanks, and vessels. Fenceline receptors are shown as purple dots surrounding the island. Note that the discrete receptors beyond the fenceline are not shown in the three-dimensional figure. However, the modeling analysis utilized a receptor grid of 100-meter spaced receptors covering approximately 2.5 kilometers. The figure also depicts the vaporizers and LNG storage tanks.

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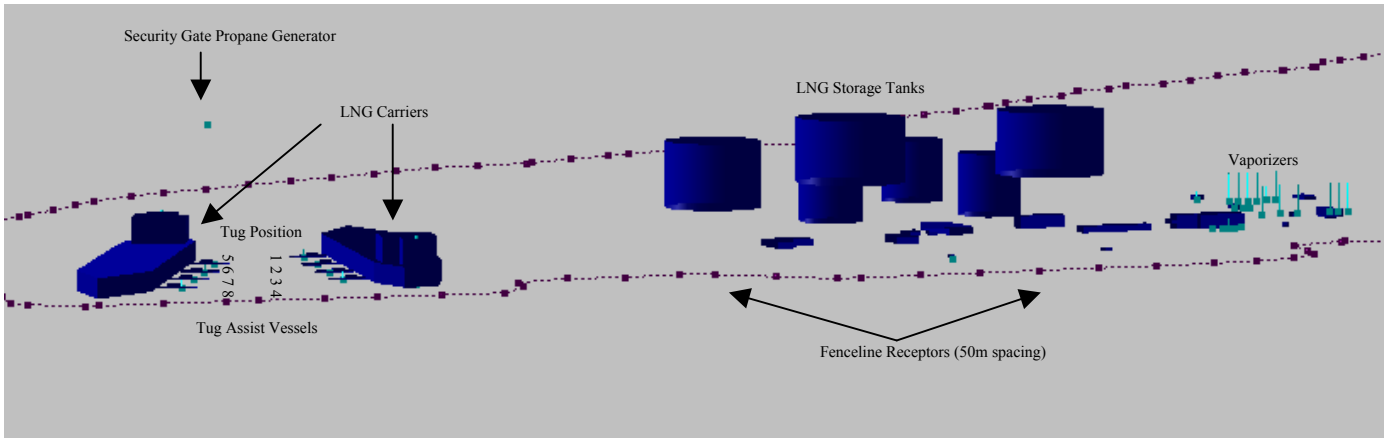
[12] 1982 through 1986 preprocessed meteorological data based on surface observations taken from Savannah, Georgia (National Weather Service [NWS] station number 03822) and upper air measurements from Waycross, Georgia (NWS station number 13861)

[13] Per 33 CFR 165.756(d)(3)(iii), all vessels less than 1,600 gross tons shall not approach within 70 yards of a moored LNG carrier as enforced in the Savannah River Regulated Navigation Area (RNA) by the U.S. Coast Guard. Vessels larger than 1,600 gross tons are escorted by two towing vessels along the channel when passing a moored LNG tankship per 33 CFR 165.756(d)(3)(ii), which is beyond the 70 yard safety zone for smaller vessels.

FIGURE 1. VISUALIZATION OF ELBA ISLAND LNG TERMINAL (VIEW FROM THE SAVANNAH RIVER)



The figure depicts two unloading carriers and one tug assist vessel for each carrier in four different locations. Note that only one tug assist vessel per carrier operates in standby mode. However, the actual location of the vessel may vary from call to call. Therefore, emissions were split even across the four locations for comparison to the annual average AAC. For comparison to the short-term average AAC, Southern LNG and Trinity determined the worst-case tug location for each carrier. For the 1-hour averaging period, it was determined that tug assist vessels located in positions 3 and 6 results in the worst-case impacts. For the 24-hour averaging period, it was determined that tug assist vessels located in positions 4 and 6 results in the worst-case impacts.

Actual stack parameters of each vessel may vary considerably. Southern LNG has collected information from its customers, Shell and BG, to model a conservative carrier stack that takes into account the parameters of each vessel and used the most conservative value of stack height, stack diameter, exhaust velocity, and exhaust temperature to generate a hypothetical worst-case carrier stack. Tug Assist stack parameters were based on information provided by BG. Table 3 presents a summary of vessel stack parameters that were used in the updated toxics modeling analysis. Recall that only TUG3 and TUG6 were included in estimating the 1-hour average impacts and only TUG4 and TUG6 were included in estimating the 24-hour average impacts. All emissions associated with tug vessels were assumed to emanate from these locations. These vessel stack parameters are identical to those used in the supplemental NO_X analysis.

TABLE 3. VESSEL STACK PARAMETERS

Stack	Description	UTM East[1] (m)	UTM North[1] (m)	Elevation (ft)	Stack Height[2] (ft)	Stack Diameter[3] (ft)	Exit Temperature[2] (°F)	Exit Velocity[2] (ft/s)
SHN1	LNG Carrier, North Berth	500,976	3,549,434	0.0	123.03	5.58	181.40	45.93
SHS1	LNG Carrier, South Berth	500,822	3,549,229	0.0	123.03	5.58	181.40	45.93
TUG1	Tug Assist, North 1	500,784	3,549,339	0.0	19.00	2.12	590.00	81.40
TUG2	Tug Assist, North 2	500,845	3,549,354	0.0	19.00	2.12	590.00	81.40
TUG3	Tug Assist, North 3	500,906	3,549,368	0.0	19.00	2.12	590.00	81.40
TUG4	Tug Assist, North 4	500,966	3,549,382	0.0	19.00	2.12	590.00	81.40
TUG5	Tug Assist, South 5	500,847	3,549,274	0.0	19.00	2.12	590.00	81.40
TUG6	Tug Assist, South 6	500,909	3,549,271	0.0	19.00	2.12	590.00	81.40
TUG7	Tug Assist, South 7	500,971	3,549,268	0.0	19.00	2.12	590.00	81.40
TUG8	Tug Assist, South 8	501,037	3,549,264	0.0	19.00	2.12	590.00	81.40

1. Carrier stack locations estimated based on drawings provided by Southern LNG, Tug Assist Vessel locations estimated in close proximity to the carriers and Elba Island offloading area.
2. Carrier stack height, exhaust temperature, and exhaust velocity based on the minimum data provided by BG or Shell, Tug Assist stack height, exhaust temperature, and exhaust velocity based on information provided by BG.
3. Carrier stack diameter based on the maximum diameter provided by BG or Shell, Tug Assist diameter based on information provided by BG.

UPDATED TOXIC AIR POLLUTANT MODELING RESULTS

The air quality modeling analyses included with this letter indicate that construction of the Elba III Terminal Expansion and continued operation of the Elba Island LNG Terminal in conjunction with secondary vessel emissions is expected to be in compliance with applicable ambient standards for toxic air pollutants under normal operating conditions. The evaluation of ambient impacts of toxic pollutant emissions was prepared in accordance with the *Guideline for Ambient Impact Assessment of Toxic Air Pollutant Emissions*, Revised June 21, 1998, which was issued by Georgia EPD pursuant to the provisions of GRAQC 391-3-1-.02(2)(a)3.(ii). The methodology used to determine the appropriate short-term and long-term AAC was consistent with EPD's *Guideline* and was provided in detailed in the April 2006 PSD application.

Dispersion modeling was conducted using the same refined modeling approach as for the PSD modeling analyses described in Section 6 of the PSD permit application for the Elba Island stationary source and the modeling approach described in this letter for the secondary vessel emissions, with one exception. Georgia EPD does not require building downwash to be modeled as part of the toxic air pollutant ambient impact assessment because of adequate safety factors incorporated in the AAC derivation scheme. Therefore, downwash was disabled from the ISC-PRIME model, making the numerical simulation identical to using ISCST3. Therefore, the ISCST3 model was used in the toxic pollutants ambient impact assessment. To obtain 15-minute average impacts, model output of 1-hour average concentrations was multiplied by the conversion factor of 1.32 specified by Georgia EPD.

The facility-wide emissions inventory presented in Appendix C of the PSD permit application along with the documentation provided in this letter includes 86 potentially toxic air pollutants, emissions of which were quantified using the emission factor resources and calculation methodology described in this letter. An updated Table 8-1 included in Attachment 4 to this letter summarizes the results of the toxic air pollutant ambient impact assessment, which indicates that emissions of potentially toxic air pollutants from the Elba Island LNG Terminal and secondary vessel emissions do not cause adverse impacts in the surrounding area because all modeled impacts are below the applicable AAC for those toxic air pollutants for which AAC can be calculated. A CD-ROM enclosed with this permit application contains all relevant model input and output files for the toxic air pollutant modeling analyses.

UPDATED PLUME VISIBILITY ANALYSIS

One of the additional impact analyses required by the PSD regulations is a visibility analysis. This analysis addresses impacts on visibility resulting from coherent plumes emanating from the Elba Island LNG Terminal. Southern LNG submitted a plume visibility analysis as part of the April 2006 PSD permit application that demonstrated the stationary sources at the Elba Island LNG Terminal do not cause visible plumes at sensitive receptors near Elba Island. Southern LNG is submitting this updated plume visibility analysis to assess plume visibility due to stationary source emissions and secondary emissions from vessels at berth at the Elba Island LNG Terminal.

The primary variables that affect whether a plume is visible or not at a certain location are (1) quantity of emissions, (2) types of emissions, (3) relative location of source and observer, and (4) the background visibility range. To assess potential plume impairment, the U.S. EPA's VISCREEN model was utilized following the guidelines published in the *Workbook for Plume Visual Impact Screening and Analysis*[14] and draft visibility modeling guidance established by Georgia EPD.[15] The VISCREEN model is designed to apply a screening methodology to determine whether a plume from a facility may be visible from a given vantage point. VISCREEN can be applied in two successive levels of screening (Levels 1 and 2). The first level provides a conservative approach using worst-case meteorological conditions and pollutant dispersion assumptions. The second level of VISCREEN modeling allows the user to adjust the worst-case meteorological assumptions based on an analysis of prevailing meteorological conditions.

The assessment of plume visibility impacts is a requirement of the federal PSD rules for air quality analyses. Georgia's SIP and GRAQC provide no specific prohibitions against visibility impairment other than regulations limiting source opacity and protecting visibility at federally protected Class I areas, pursuant to Rule 391-3-1-.02(uu) *Visibility Protection*. All stationary sources at the Elba Island LNG Terminal will maintain compliance with applicable opacity restrictions by combusting clean-burning natural gas exclusively. To otherwise demonstrate that local visibility impairment will not result from continued operation of the Elba Island LNG Terminal, the VISCREEN model was applied at the sensitive receptors listed in Table 4 that are located within 50 km of Elba Island. Areas that are typically considered sensitive receptors include regional, national, or international airports, historic sites, state parks or forests, or national parks or forests that are not designated federal Class I areas. Note that none of these sensitive receptors is located within the modeled significant impact area associated with the Elba III Terminal Expansion.

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[14] U.S. Environmental Protection Agency, *Workbook for Plume Visual Impact Screening and Analysis*, EPA-450/4-88-015, 1988.

[15] Personal electronic communication from Mr. Peter Courtney (Georgia EPD) to Mr. Ryan Gesser (Trinity Consultants), October 26, 2005.

TABLE 4. SENSITIVE VISIBILITY RECEPTORS FOR ADDITIONAL IMPACTS ANALYSIS

Receptor	Distance (km)
Wormsloe Historic Site	11.5
Skidaway Island State Park	13.8
Savannah Hunter Army Airfield	13.3
Savannah International Airport	18.9
Fort McAllister Historic Park	28.0
Hilton Head (SC) Airport	31.4
Beaufort County (SC) Airport	49.2

VISCREEN PLUME VISIBILITY ANALYSES

For a Level-1 VISCREEN analysis, default particulate size and density and worst-case meteorological conditions of F stability with a 1.0 m/s wind speed were used. These worst-case meteorological conditions are assumed to persist for 12 hours with a wind direction that would transport the plume directly adjacent to the observer. In the visibility analysis, the facility-wide potential emissions PM_{10} and NO_X including the Elba III Terminal Expansion and vessels at berth were used as input to the model. Remaining Level-1 input parameters were set to those values specified by the VISCREEN user's manual as listed in Table 5.[16] As directed in the *Workbook*, a background visual range of 25 km was used for the area of Southeastern Georgia where Elba Island is located.

TABLE 5. INPUTS TO THE VISCREEN MODEL FOR THE LEVEL-1 VISIBILITY IMPAIRMENT ANALYSIS.

Parameter	Input Value
Particulate Emission Rate	60.4 tpy
NO_X Emission Rate	980 tpy
Background ozone	0.04 ppm
Plume-source-observer angle	11.25°
Background visual range	25 km

For views at each area selected, calculations were performed by the model for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. VISCREEN assumes that the terrain object is black and located adjacent to the plume on the side of the centerline opposite the observer. The VISCREEN model output shows separate tables for inside and outside of the sensitive area. Each table contains several variables: theta, azi, distance, alpha, critical and actual plume ΔE, and critical and actual plume contrast. These variables are defined as:

1. *Theta* - Scattering angle (the angle between direction solar radiation and the line of sight). If the observer is looking directly at the sun, theta equals zero degrees. If the observer is looking away from the sun, theta equals 180 degrees.

[16] U.S. Environmental Protection Agency, *Tutorial Package for the VISCREEN Model*, U.S. EPA OAQPS, Research Triangle Park, NC, June 1992.

2. *Azi* - The azimuthal angle between the line connecting the observer and the line of sight.
3. *Alpha* - The vertical angle between the line of sight and the plume centerline.
4. ΔE - Used to characterize the perceptibility of a plume on the basis of the color difference between the plume and a viewing background. A ΔE less than 2.0 signifies that the plume is not perceptible.
5. *Contrast* - The contrast at a given wavelength of two colored objects such as plume/sky or plume/terrain. A value less 0.05 signifies that the plume is not perceptible by contrast or color.

The analysis is considered satisfactory if ΔE and *Contrast* are less than critical screening values of 2.0 and 0.05, respectively. Note that these thresholds are applied in this analysis, even though screening criteria are properly applied at Class I areas, not sensitive receptors located in Class II areas.

Level-1 screening techniques were adequate to demonstrate plume impairment values below screening thresholds for the most distant receptor, Beaufort County Airport. A Level-2 screening analysis was required for the other six locations within the near field region: Hilton Head Airport, Fort McAllister Historic Park, Savannah International Airport, Savannah Hunter Army Airfield, Wormsloe Historic Site, and Skidaway Island State Park.

For the Level-2 analysis, the worst case meteorological conditions were determined by creating a joint frequency distribution of atmospheric stability and wind speeds for the five-year data period 1982 through 1986 from observations at Savannah, Georgia. This data period was chosen to coincide with meteorological data years used in the Class II modeling analyses for consistency and to take advantage of readily available meteorological data. This analysis indicated the combination of atmospheric stability and wind speed conditions ($\sigma_y \sigma_z u$, the product of lateral and vertical dispersion coefficients and wind speeds) having a cumulative probability of 1 percent that would potentially cause plume impairment at the location of each sensitive receptor during periods when winds were likely to transport the plume toward the receptor. No other alterations to the default conservative assumptions were made in the model runs. Table 6 summarizes the results at each sensitive receptor for views inside and outside the sensitive receptor.

TABLE 6. SUMMARY OF VISIBILITY SCREENING ANALYSIS

Sensitive Receptor	Worst-Case Dispersion Condition	SLNG & Vessel Maximum ΔE (Inside/Outside)	Does SLNG's ΔE Exceed the Criteria Threshold?	SLNG & Vessel Maximum |Contrast| (Inside/Outside)	Does SLNG's *Contrast* Exceed the Criteria *Contrast*?
Wormsloe Historic Site	(D,1)	2.5/4.0	Yes	0.009/0.020	No
Skidaway Island State Park	(F,3)	2.1/2.6	Yes	0.008/0.013	No
Savannah Hunter Army Airfield	(D,1)	2.1/3.0	Yes	0.008/0.016	No
Savannah International Airport	(F,3)	1.5/1.6	No	0.006/0.007	No
Fort McAllister Historic Park	(F,3)	0.8/0.8	No	0.004/0.004	No
Hilton Head (SC) Airport	(E,3)	0.4/0.4	No	0.002/0.002	No
Beaufort County (SC) Airport	(F,1)*	0.8/0.8	No	0.005/0.005	No

* (F,1) denotes that acceptable visibility impacts were demonstrated under Level-1 default assumption of worst-case meteorological conditions.

The Level-2 VISCREEN analysis indicates that plume visibility impairment does not occur at the following four areas: Beaufort County (SC) Airport, Hilton Head (SC) Airport, Fort McAllister Historic Park, and Savannah International Airport. Additional analyses were required to assess visibility impacts at Wormsloe Historic Site, Hunter Army Airfield, and Skidaway Island State Park.

VISCREEN output files are included in Attachment 5 to this documentation and VISCREEN input and output files are included on the enclosed CD-ROM.

PLUVUE-II PLUME VISIBILITY ANALYSES

A Level-3 analysis using the PLUVUE-II visibility impairment model was conducted for the three areas (Wormsloe Historic Site, Hunter Army Airfield, and Skidaway State Park) at which visibility impairment was predicted by the Level-2 VISCREEN analysis. PLUVUE-II uses a Gaussian plume model formulation to simulate plume dispersion as a function of atmospheric conditions and downwind transport. PLUVUE-II estimates the formation of secondary pollutants such as sulfates and nitrates that form during plume transport due to primary emissions of SO_2 and NO_X. These secondary pollutants, in addition to primary emissions of PM, cause the plume to be perceptible within a critical distance before which the plume is too disperse to be visible. PLUVUE-II also simulates actual plume-source-observer geometries for different wind directions to simulate views of a plume from different angles.

PLUVUE-II estimates plume perceptibility in terms of four parameters: (1) percent reduction in visual range; (2) plume contrast; (3) blue-red ratio of the plume; and, (4) color change perception parameter. The *PLUVUE-II User's Guide* (U.S. EPA, 1996) presents the following summary information about these criteria. Each of these parameters can be calculated with respect to different viewing backgrounds. PLUVUE-II calculates visibility impacts compared to a sky background, white background, grey background, and black background.

- **Visual Range Reduction.** This parameter is the percentage reduction in visual range (the farthest distance one can see a large, black object) caused by the plume material. This parameter can be interpreted to indicate the haziness or loss of contrast of viewed landscape features caused by plume material.
- **Plume Contrast.** This parameter is the relative brightness of a plume compared to a viewing background. A contrast that is positive indicates a relatively bright plume and a negative contrast indicates a dark plume. Contrasts with absolute values greater than 0.02 are generally perceptible. A two percent contrast is used to define visual range. Plume contrast calculations in PLUVUE II are done at one wavelength, 0.55 μm, which is a green color in the middle of the visible spectrum, which extends from 0.4 μm (blue) to 0.7 μm (red).
- **Blue-Red Ratio.** This parameter indicates the relative coloration of a plume relative to its viewing background. Blue-red ratios less than one indicate relatively yellow, red, or brown plumes. Blue-red ratios greater than one indicate plumes that are whiter, grayer, or bluer than the viewing background. Blue-red ratios less than 0.9 or greater than 1.1 would be indicative of perceptible plumes.
- **Color Contrast Parameter (ΔE).** The color contrast parameter or ΔE is probably the best single indicator of the perceptibility of a plume due both to its contrast and its color with respect to a viewing background. ΔE is calculated for the entire visible spectrum and indicates how different the brightness and color of plume and background are. The larger the value of ΔE, the greater the perceptibility of the plume. Under ideal viewing conditions, when the viewing background is uniform and the plume is sharp-edged, a just perceptible ΔE would be one; for cases of plumes with diffuse edges, a just perceptible ΔE threshold would be greater than one, perhaps two.

Because U.S. EPA identifies the Color Contrast Parameter ΔE as the single most important indicator of plume perceptibility, ΔE is used as the metric to determine whether visible plume impairment would occur as a result of emissions at the Elba Island LNG Terminal by comparison to the critical value threshold of 2.0.

PLUVUE-II requires more detailed information about the source and atmospheric conditions to perform the more refined Level-3 analysis. Table 7 summarizes values for parameters for which no default is available that were used to assess plume impairment from the Elba Island LNG Terminal including secondary emissions from vessels at berth. Notable refined inputs into PLUVUE-II include the meteorological conditions and terrain and primary emissions of precursors to visibility-affecting pollutants. The following information provides more details about these inputs to describe the methodology for conducting the Level-3 analysis.

Source and Observer Locations

UTM coordinates of the source and observer locations are input to PLUVUE-II, which calculates the plume-source-observer geometry for each simulation. The PLUVUE *User's Guide* does not provide clear guidance on where observers should be located, but the Case Study presented in Section 3 of the PLUVUE *User's Guide* does provide some rationale for where observers are located in the context of a Class I area analysis:

> *Three observer locations are used in this study. Observer #1 was selected to represent the impact at the closest park boundary to the repository site. This observer location is likely to have the worst visual impacts because it is only 1.9 km from the center of the proposed site and it has a relatively unobstructed view down the canyon toward the site. Although this site is likely to have the worst magnitude and frequency of visual impacts, in reality the site may rarely, if ever, be visited. Observer #2 was chosen at a location that is visited by 4 percent of the national park visitors. The site is approximately 4 km from Observer #1 and 6 km from the canyon site. Finally, the third observer (#3) is immediately adjacent to the ranger station on the entrance road to the national park. This site was chosen because, although it is further from the canyon site (approximately 9 km), it is visited quite often and has a relatively unobstructed view in several directions. This area is visited by 12 percent of the park visitors and more visitors drive past this location.*

In other words, all observers are located within the Class I area to assess whether a plume is visible to an observer at the sensitive receptor. The case study does not suggest or follow specific guidance for simulating certain observation angles, but rather simulates a wide variety of wind directions for common stability classes to get an overall feel for the frequency and magnitude of visibility impairment. For example, Tables 5, 6, and 7 of the PLUVUE *User's Guide* show summaries of impacts for several wind directions without emphasis on any particular direction toward, or within a certain angle of, the orientation between source and observer. The Case Study acknowledges "essentially all of these observations of plume impact would be of emissions located outside the park boundary

while observed within the park boundary" (PLUVUE *User's Guide* page 99) as if to distinguish that plume impairment within the boundary was most critical.

Accordingly, PLUVUE-II simulations for the Wormsloe Historic Site, Hunter Army Airfield, and Skidaway Island State Park were constructed to evaluate whether plumes were visible to observers located at each sensitive receptor under a wide range of meteorological conditions. Figure 2 illustrates the location of the Elba Island LNG Terminal relative to critical wind directions likely to transport a visible plume from the source toward each sensitive receptor. PLUVUE-II simulates whether the plume is visible from the observer's location at user-selected downwind distances from the plume source. Eight downwind distances were selected for this analysis to represent downwind distances near the source and approaching, at, and beyond the sensitive receptor.

FIGURE 2. RELATIVE LOCATION OF ELBA ISLAND LNG TERMINAL AND SENSITIVE RECEPTORS

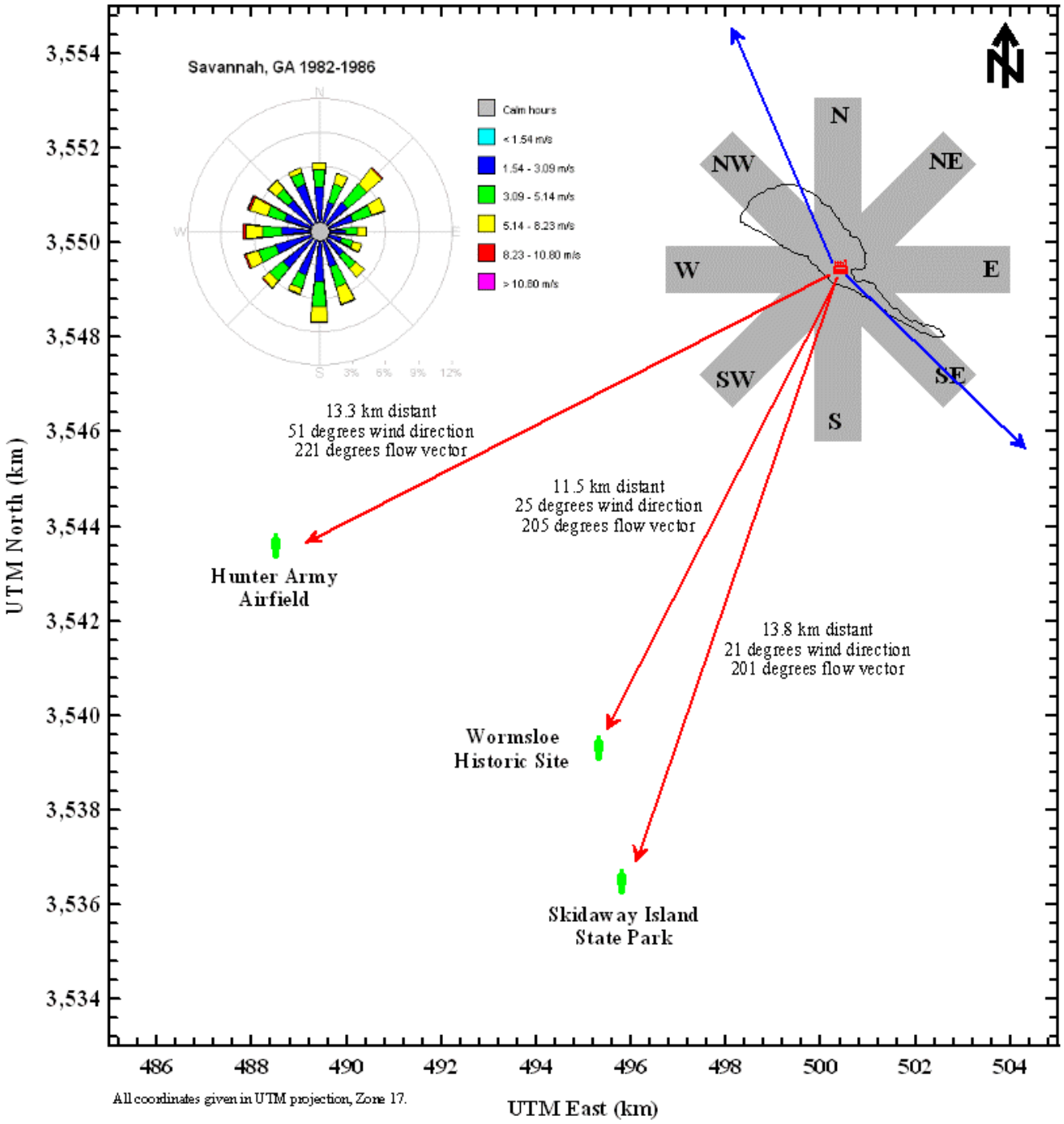

TABLE 7. LEVEL-3 PLUVUE-II ANALYSIS INPUT PARAMETERS

Parameter	Value	Reference/Comment
PLUVUE-II Run Title	Site-Specific	Sensitive receptor name
Wind Speed (mph)	Site-Specific	Worst case parameters determined in Level-2 VISCREEN analysis
Pasquill-Gifford Stability Class Index		
Index for Wind Speed Measurement Height	1	7 m above ground level
Mixing Depth (meters)	Time-of-day Dependent	10th percentile of rural mixing height values for 1982-1986 meteorological data set for selected times of day
Relative Humidity (percent)	Time-of-day and Season Dependent	Mean relative humidity for Savannah by month and time-of-day
Number of Downwind Distances Modeled	8	Chosen to assess plume visibility at locations near the source and at and beyond the sensitive receptor
Downwind Distances Modeled	1, 2.5, 5, 7.5 10, 12.5, 15, and *x*	*x* denotes the distance of the sensitive receptor: Wormsloe Historic Site *x* = 11.5 km Savannah Hunter Army Airfield *x* = 13.3 km Skidaway Island State Park *x* = 13.8 km
Total SO_2 Emissions (tons per day)	6.23	Short-term potential emissions from stationary sources and vessels at berth
Total NO_X Emissions (tons per day)	4.47	
Total PM Emissions (tons per day)	0.60	
Flue Gas Flow Rate (acfm) per stack	67,332.1	Stack parameters for typical LNG Carrier since the majority of emissions come from these stacks
Flue Gas Exit Temperature (°F)	181.4	
Flue Gas Exhaust Velocity (meters per second)	14.00	
Stack Height (feet)	123.0	
Flue Gas Oxygen Content (mole percent)	3.0	Default value
Units	27	23 stationary source emission points plus four representative stacks for vessel operations
Ambient Temperature (°F)	52.5	Mean daily dry bulb temperature for February, May, August, and November, respectively, for Savannah
	73.2	
	81.1	
	58.2	
Ambient [NO_X] (parts per million)	0.045	Maximum observed concentrations reported in Georgia EPD's *2004 Ambient Air Surveillance Report* for Savannah, or where no monitors are located in Savannah, statewide
Ambient [NO_2] (parts per million)	0.017	
Ambient [O_3] (parts per million)	0.040 (default)	
Ambient [SO_2] (parts per million)	0.022	
Ambient [PM_{10}] (micrograms per cubic meter)	22.8	
Ambient Background Visual Range (km)	25.0	Savannah area reference value
UTM Coordinates and Elevation of Observer	495.3, 3539.3, 0	Wormsloe Historic Site
	495.8, 3536.5, 0	Skidaway Island State Park
	488.5, 3543.6, 0	Savannah Hunter Army Airfield
UTM Coordinates and Elevation of Source	500.4, 3549.5, 0	Elba Island LNG Terminal
Month and Day of Simulation	2/1 5/1 8/1 11/1	Multiple conditions simulated to represent Winter, Spring, Summer, and Fall
Time of Day	700 1000 1300 1600	7am to represent "F" Stability Index 10am to represent "D" Stability Index
Base Time Zone	5 4	During Standard Time (February and November) During Daylight Savings Time (May and August)
Terrain Elevations along Plume Trajectory (meters)	0.0	Flat Terrain Assumption
Distance to Background Terrain (km)	25.0	Set equivalent to background visual range
Wind Direction (azimuth degrees from which wind blows)	WNW, NW, NNW, N, NNE, NE, ENE, E, ESE, SE, SSE	Range of wind directions modeled to simulate various plume angles relative to observers

Meteorological Conditions

Initial PLUVUE runs simulated the wind speed and stability index as calculated in the Level-2 VISCREEN analysis and tabulated in Table 6 for the selected sensitive receptors. To assess the sensitivity of a wide range of plume-source-observer and solar conditions, PLUVUE runs were conducted for multiple times during daylight hours (0700, 1000, 1300, 1600 local time) and seasons (Winter represented by February 1, Spring represented by May 1, Summer represented by August 1, Autumn represented by November 1).

The mixing height for each simulation was estimated to be the median value of hourly rural mixing heights in the 1982-1986 Savannah meteorological data for each time of day during which the one-percent worst case stability index occurred. For Wormsloe Historic Site and Hunter Army Airfield, "D" (neutral) stability was found to represent worst-case conditions at the one percent cumulative probability level. For Skidaway State Park, "F" (stable) stability during worst-case conditions. This analysis of observed mixing heights indicated that F stability never occurs at 1000, 1300, or 1600 hours, so to model daytime conditions other than F stability for Skidaway, the next conditions in the joint frequency cumulative probability distribution occurring during daylight hours was D stability and 1 m/s, at about the two percent cumulative probability. Accordingly, D stability and 1 m/s was simulated at all times for Wormsloe Historic Site and Hunter Army Airfield and at Skidaway Island State Park for 1000, 1300, 1600 hours. F stability and 3 m/s wind speed was initially analyzed at Skidaway Island State Park at 0700 hours.

A range of wind directions between Northwest (NW, 315°) and South-southeast (SSE, 157.5°) at 22.5° increments were simulated to assess the sensitivity of plume visibility to various angles of plume-source-observer. As depicted in Figure 2, this range of wind directions captures flow toward and within a 90° angle of each sensitive receptor. An analysis of wind measurements at Savannah shows that winds blow within this sector approximately 50% of the time.

Normals, means, and extremes as tabulated in the National Climatic Data Center's *Local Climatological Data* (1999 Edited Annual Summary) were referenced for values of relative humidity at each time of day and month simulated, as well as ambient temperature (daily mean dry bulb) for each season simulated.

Source Representation

Primary emissions of SO_2, NO_X, and PM from stationary sources and vessels at berth were input to PLUVUE-II. Worst-case short term emissions of these pollutants were based on heavy fuel oil firing. A total of 27 units were input to represent the 23 stationary source emission points and four vessels (typical for two cargo ship and two support vessels during offloading operations). Stack parameters for a typical LNG Carrier vessel were chosen to be representative for the analysis since the majority of emissions emanate from these sources.

Terrain and Visual Background

Because the coastal plain of Georgia in which the source and sensitive receptors are located is relatively flat, no terrain elevations were simulated and the terrain background was estimated at 25 km distant to represent the background visual range. PLUVUE-II computed plume perceptibility (ΔE) relative to sky and white, grey, or black background objects. Since the plume is elevated and there are no terrain features within the visual range, PLUVUE-II results for the sky background were evaluated for this analysis.

Ambient Pollutant Concentrations

PLUVUE-II accepts as input background concentrations of visibility-affecting pollutants such as NO_X, NO_2, SO_2, and PM_{10} to simulate whether an emitted plume would be visible relative to a well-mixed atmosphere. Background levels of these pollutants were input to PLUVUE-II as tabulated in Table 7 based on review of Georgia EPD's 2004 *Ambient Air Surveillance Report*. Conservative values for Savannah area monitors (if available) or statewide background levels were chosen.

PLUVUE-II Results

The previously described methodology results in a total of 176 simulations for each sensitive receptor to consider various combinations of four times of day, four seasons, and eleven wind directions, or a total of 528 PLUVUE-II runs. The results of this initial analysis indicate that a plume is never visible (i.e., ΔE is less than 2.0) for oblique angles of plume transport toward the observer. In other words, the plume may be visible only when the wind is blowing so as to transport the plume directly from the source to sensitive receptor location. Accordingly, plumes *may be* visible at the sensitive receptor locations only when wind is blowing from the ENE toward Hunter Army Airfield, which occurs approximately 5.3% of the time, or from the NNE toward Wormsloe Historic Site and Skidaway Island State Park, which occurs approximately 4.7% of the time. However, these results do not indicate that a plume is always visible when the wind blows from these directions, since mixing and optical conditions at certain times of day and for certain wind speeds cause the plume to not be visible.

At Hunter Army Airfield, visual plumes are predicted during worst case stability (D) and wind speed (1 m/s) at 0700 hours during Summer and 1600 hours during all seasons. This result is likely primarily due to low solar elevation angle at these hours of day. Of the 176 simulations performed for Hunter Army Airfield, plume perceptibility ($\Delta E > 2.0$) was predicted for only five simulations (2.8%) with a maximum value of 3.436 outside the airport and 1.872 at the airport. The plume is never perceptible at the downwind distance of the sensitive receptor; in other words, the observer only sees the plume near the source or beyond the observer location, but it is not perceptible at the location of the sensitive receptor.

At Wormsloe Historic Site, visual plumes are predicted during worst case stability (D) and wind speed (1 m/s) at 0700 hours during Winter and 1600 hours during all seasons. This result is likely primarily due to low solar elevation angle at these hours of day. Of the 176 simulations performed for Wormsloe Historic Site, plume perceptibility ($\Delta E > 2.0$) was

predicted for only five simulations (2.8%) with a maximum value 3.522 outside the site and 1.880 at the observer location. The plume is never perceptible at the downwind distance of the sensitive receptor; in other words, the observer only sees the plume near the source or beyond the observer location, but it is not perceptible at the location of the sensitive receptor.

At Skidaway Island State Park, visual plumes are predicted during worst case stability (F) and wind speed (3 m/s) at 0700 hours during Winter and Autumn and during worst case stability (D) and wind speed (1 m/s) 1600 hours during all seasons. This result is likely primarily due to low solar elevation angle at these hours of day. Of the 176 simulations performed for Skidaway Island State Park, plume perceptibility ($\Delta E > 2.0$) was predicted for only six simulations (3.4%) with a maximum value of 4.275 outside the park and 2.117 at the observer location. The plume is rarely perceptible (two simulations) at the downwind distance of the sensitive receptor; in other words, the observer typically only sees the plume near the source or beyond the observer location, but it is usually not perceptible at the location of the sensitive receptor.

In general, the results of these analyses indicate that visible plumes attributable to the Elba Island LNG Terminal rarely occur at sensitive receptors because the presence of visible plume is very sensitive to wind direction and occurs only during particular optical conditions of low sun angle. Plume visibility is a function of downwind distance from the source with maximum plume visibility near the source's location, and only very rarely (two simulations) is the plume perceptible at the location of the observer.

Model input and output files for the VISCREEN and PLUVUE modeling analyses are included on the CD-ROM enclosed with this letter for additional review. Because the Level-3 PLUVUE-II plume visibility analysis indicates that a visible plume rarely occurs under worst case meteorological and optical conditions at the location of the Wormsloe Historic Site, Savannah Hunter Army Airfield, and Skidaway Island State Park, the analysis indicates that emissions from the Elba Island LNG Terminal, including secondary emission sources, do not cause significant visibility impairment at any sensitive receptors in the surrounding area.

ATTACHMENT 1
Georgia EPD Information Requests

Georgia Department of Natural Resources
Environmental Protection Division • Air Protection Branch
4244 International Parkway • Suite 120 • Atlanta • Georgia 30354
404/363-7000 • Fax: 404/363-7100
Noel Holcomb, Commissioner
Carol A. Couch, Ph.D., Director

SEP 14 2006

RECEIVED
SEP 21 2006
By

Mr. James Tangeman
Principal, Eastern Pipelines Air Group
Southern LNG, Inc.
AmSouth Building, 1900 Fifth Avenue North
Birmingham, Alabama 35203

Re: Title V Significant Modification Application No. TV-16697 dated April 6, 2006
Southern LNG Inc. – Elba Island LNG Terminal, Savannah (Chatham County)

Dear Mr. Tangeman:

I have reviewed the additional emission calculations contained within the PSD application (No. TV-16697), and have a question regarding potential emission increases of particulate matter (PM/PM10) from the proposed vaporizer boilers (ID Nos. V009 – V014). On page 4 of Appendix C of the application, the hourly PM10/PM2.5 emission factor is listed as 0.22 pounds per hour. The PM10/PM2.5 emission factor you used appears to be the filterable PM emission rate from EPA AP-42. The Division is concerned that you did not include condensable PM emissions. Since condensable PM can be much higher than filterable PM, we are concerned that the increase in PM10 emissions from this project would exceed 15 tpy, and a BACT determination for PM10 and modeling of PM10 would be required.

I discussed this with Ryan Gesser on September 13 and Mr. Gesser pointed out that, on Page 57 of Appendix C, it indicates that the actual PM10 emissions rate from submerged combustion is anticipated to be at a level consistent with AP-42 emission factors for filterable PM10, based on manufacturer's technical assessment. This was helpful but it did not resolve the question. The Division is therefore requesting written documentation from the manufacturer, such as a specification datasheet, that demonstrates what the PM/PM10 emission rate (including filterable and condensable PM) from Vaporizer Boilers V009 – V014 is predicted to be. We need this documentation to ensure that the additional PM10 emissions from this modification project will not exceed 15 tpy and no BACT determination or PSD modeling will be required for PM10.

Please submit the requested documentation as soon as possible, but no later than **October 15, 2006**. EPD's review of the permit application will resume upon our receipt of the requested information. If you have any questions or need more information, please contact me at (404) 363-7114 or via email at Jeng-Hon_Su@dnr.state.ga.us.

Sincerely,

Jeng-Hon Su

Jeng-Hon Su
Environmental Engineer
Stationary Source Permitting Program

c: Ryan Gesser, Trinity Consultants

Georgia Department of Natural Resources
Environmental Protection Division • Air Protection Branch
4244 International Parkway • Suite 120 • Atlanta • Georgia 30354
404/363-7000 • Fax: 404/363-7100
Noel Holcomb, Commissioner
Carol A. Couch, Ph.D., Director

SEP 25 2006

RECEIVED
SEP 28 2006
By

Mr. James Tangeman
Principal, Eastern Pipelines Air Group
Southern LNG, Inc.
AmSouth Building, 1900 Fifth Avenue North
Birmingham, Alabama 35203

Re: Title V Significant Modification Application No. TV-16697 dated April 6, 2006
Southern LNG Inc. – Elba Island LNG Terminal, Savannah (Chatham County)

Dear Mr. Tangeman:

The Division has reviewed your letter and the attached "Statement of Facts on Common Control" dated July 26, 2006, in response to our additional information request letter dated June 5, 2006. Your letter indicates that your main concern is whether the emissions from the vessels, while unloading liquefied natural gas (LNG) with its onboard equipment, and the emissions from your land-based facility should be aggregated for a Prevention of Significant Deterioration (PSD) review. The Division agrees with the statement in your letter that those two emission categories should be aggregated for a PSD review only if, among other things, your land-based facility and the LNG ships at berth are under "common control" and are considered as a combined source under Title V and PSD.

"Statement of Facts on Common Control" first provided basic background information of your facility, clients, and the LNG ships. Then it discussed the common control issue and used the Georgia EPD's *Site Determination Guidance* to show why emissions from the vessels while unloading LNG should not be included as part of the stationary source at the Elba Island Terminal or modeled for permitting purposes. Below is an abstract of the information presented in "Statement of Facts on Common Control":

1. According to Items 9 – 13 of the statement, Southern LNG Inc. (SLNG) operates an LNG import terminal under the Federal Energy Regulatory Commission's (FERC) regulations for open-access transportation of natural gas. Two companies, BG LNG Services LLC (BGLS) and Shell NA LNG LLC (SNALNG), are SLNG's main customers and own the natural gas. SLNG does not own the natural gas; it just transports and holds natural gas for BGLS and SNALNG.

2. According to Items 18 – 21 of the statement, SLNG is a wholly owned subsidiary of Southern Natural Gas (SNG), which in turn is a wholly owned subsidiary of El Paso Corporation. Neither SLNG nor its parent companies own a controlling interest in or is under common control with BGLS or SNALNG.

3. According to Items 17 and 23 – 26 of the statement, BGLS and SNALNG make their own arrangements to have their LNG transported to your facility. None of the LNG ships is owned, operated, or managed by SLNG. Although the parents of BGLS and SNALNG, BG Group Plc and Royal Dutch Shell Plc, may through separate subsidiaries in combination with other independent entities manage some of the LNG ships, the vast majority of the LNG ships are owned, operated, and managed by other entities.

4. According to Items 35 – 83 of the statement, you used the scoring system listed in Georgia EPD's *Site Determination Guidance* and evaluated whether the SLNG Elba Island facility and the LNG ships (at berth) should be considered as one source. According to the information provided in the statement, you scored a total of zero (0) under the Common Control subcategory. Under the Common Control subcategory, since your score is less than 200, EPD guidance indicates that common control does not likely exist.

Although the Division may not agree with your statement that the permitting history of SLNG has shown a settled practice between GA EPD and SLNG on vessel unloading emissions, the Division agrees with the facility that there is no common control between Southern Natural Gas Inc. – Elba Island and the LNG ships. Emissions from the LNG ships when unloading LNG should not be considered toward PSD applicability nor included in SLNG's potential to emit.

However, emissions from the LNG ships when unloading must still be included in the modeling for ambient air quality reviews and additional impact analyses. These emissions are considered as secondary emissions. Secondary emissions mean emissions which would occur as a result of the construction or operation of a major stationary source or major modification, but do not come from the major stationary source or major modification itself. Since the proposed six new vaporizer boilers and two new LNG storage tanks will increase the facility's capacity, more LNG ships will be called to deliver more LNG. It is expected that emissions from unloading LNG will increase as a result of this modification. In order to safeguard Georgian's health, safety, and welfare, modeling that includes both emissions from your land-based facility and LNG vessels when unloading LNG is required. Even though you are only required to do PSD modeling for the pollutants that this project is significant for, we are requesting that you submit emissions data for NOx, SO_2, PM_{10}, and CO since we may need that emissions data for other projects.

Considering the time spent on preparing the common control statement and reviewing it, the Division extends the deadline of the submittal of a new CD containing the updated Title V and PSD application (with the new modeling) to **October 31, 2006**. EPD's review of the permit application will resume upon our receipt of the requested information. If you have any questions or need more information, please contact me at (404) 363-7020 or via email at James_Capp@dnr.state.ga.us.

Sincerely,

James Capp

James Capp
Program Manager
Stationary Source Permitting Program

c: Jim Little, Pete Courtney

Georgia Department of Natural Resources
Environmental Protection Division • Air Protection Branch
4244 International Parkway • Suite 120 • Atlanta • Georgia 30354
404/363-7000 • Fax: 404/363-7100
Noel Holcomb, Commissioner
Carol A. Couch, Ph.D., Director

SEP 28 2006

OCT 05 2006
BY

Mr. James Tangeman
Principal, Eastern Pipelines Air Group
Southern LNG, Inc.
AmSouth Building, 1900 Fifth Avenue North
Birmingham, Alabama 35203

Re: Title V Significant Modification Application No. TV-16697 dated April 6, 2006
Southern LNG Inc. – Elba Island LNG Terminal, Savannah (Chatham County)

Dear Mr. Tangeman:

During its review of the emissions modeling for the Elba III modification project, the Division's Data and Modeling Unit has become concerned that the toxic analysis in Chapter 8 of your PSD Application (No. TV-16697) dated April 6, 2006 is deficient. They noted that the ambient impact assessment of toxic air pollutant emissions was conducted using only the facility emissions inventory presented in Appendix C of this permit application. While this includes 83 toxic air pollutants, the emissions inventory in Appendix C does not include any toxic air pollutant emissions from the vessels when unloading LNG and hoteling.

During the facility tour on August 25, 2006, EPD learned that the LNG vessels normally fire heavy fuel oil when docked at the berth and unloading LNG. The Division is concerned that the toxic air pollutant emissions from vessels, firing heavy fuel oil has not been evaluated. To comply with Georgia Air Quality Rule 391-3-1-.02(2)(a)3(ii) and Georgia Toxic Guidelines, in order to safeguard the public health, safety, and welfare of the people of the State of Georgia, I request that you submit an updated ambient impact assessment of toxic air pollutant emissions, including both facility and vessel emissions, by **October 31, 2006**.

EPD's review of the permit application will resume upon our receipt of the requested information. If you have any questions or need more information, please contact me at (404) 363-7114 or via email at Jeng-Hon_Su@dnr.state.ga.us.

Sincerely,

Jeng-Hon Su
Environmental Engineer
Stationary Source Permitting Program

c: Ryan Gesser, Trinity Consultants

Georgia Department of Natural Resources
Environmental Protection Division • Air Protection Branch
4244 International Parkway • Suite 120 • Atlanta • Georgia 30354
404/363-7000 • Fax: 404/363-7100
Noel Holcomb, Commissioner
Carol A. Couch, Ph.D., Director

OCT 18 2006

OCT 23 2006

Mr. James Tangeman
Principal, Eastern Pipelines Air Group
Southern LNG, Inc.
AmSouth Building, 1900 Fifth Avenue North
Birmingham, Alabama 35203

Re: Title V Significant Modification Application No. TV-16697 dated April 6, 2006
Southern LNG Inc. – Elba Island LNG Terminal, Savannah (Chatham County)

Dear Mr. Tangeman:

During its review of the emissions modeling for the Elba III modification project, the Division's Data and Modeling Unit has found another deficiency in Section 6 "PSD Air Quality Analysis" of the PSD application (No. TV-16697). Southern LNG and Trinity Consultants submitted an updated air quality modeling analysis to analyze the impacts attributable to vessels at berth in conjunction with the Elba Island LNG Terminal on September 1, 2006. However, you have not updated Section 6.5.3 "Plume Visibility" of your PSD application which should also include the impact by vessels' NOx emissions from LNG unloading and hoteling.

According to Mr. Ryan Gesser and Richard Monteith's conversation, Trinity expects to include the updated Section 6.5.3 within the updated Title V and PSD application that is due by **October 31, 2006**.

EPD's review of the permit application will resume upon our receipt of the requested information. If you have any questions or need more information, please contact me at (404) 363-7114 or via email at Jeng-Hon_Su@dnr.state.ga.us.

Sincerely,

Jeng-Hon Su
Environmental Engineer
Stationary Source Permitting Program

c: Ryan Gesser, Trinity Consultants

ATTACHMENT 2
Vaporizer PM Emission Factor Documentation Letter

SELAS FLUID PROCESSING CORPORATION
A Member of the Linde AG Group

RECEIVED
OCT 17 2006
By

Linde

October 17, 2006

Mr. James G. Tangeman
El Paso Corporation
Eastern Pipelines – Principal (Air Group)
AM South Center
1900 Fifth Avenue North
Birmingham, AL 35203

RE: Expected Particulate Matter Emissions from a Single Burner Submerged Combustion LNG Vaporizer

Dear James,

Stack gas sampling for particulate emissions was conducted on a single burner submerged combustion LNG vaporizer (SCV) in October 2005. The SCV was being operated at design load conditions during the sampling runs. Three consecutive sampling runs were completed according to USEPA protocol by an independent, third party organization.

A stack sample port conforming to USEPA guidelines was used for gas sampling with a twelve point traverse pattern. The front-half sampling train was setup according to USEPA Method 5 and the rear-half sampling train followed USEPA Method 202. The independent, third party organization supplied all equipment, performed calibrations, maintained custody chain, and adhered to laboratory standards certification with their reported results.

The results were averaged and reported as filterable and condensable particulate portions. Filterable particulate matter was averaged at a value of 1.09E-03 lb/MM Btu HHV and condensable particulate matter was averaged at a value of 4.05E-04 lb/MM Btu HHV. The combined particulate matter emissions average value was 1.5E-03 lb/MM Btu HHV. The isokinetic sampling rate for all three runs was within plus/minus 2% of the optimal 100% rate.

Regards,

Peter W. Falcone, P.E.
Product Development Manager
Selas Fluid Processing Corporation
Five Sentry Parkway East
Blue Bell, PA 19422

TMX

5 Sentry Parkway East
Blue Bell, PA 19422 USA

Telephone (610) 834-0300
Fax (610) 834-0473
http://www.selasfluid.com

ATTACHMENT 3
Indirect Vessel Emissions Supporting Documentation

Table 1. Summary of Actual Vessel Emissions at Elba LNG Terminal (August 2004 - August 2006)[1]

Vessel	NO_X Emissions (tpy)	SO_2 Emissions (tpy)	CO Emissions (tpy)	PM_{10} Emissions (tpy)	VOC Emissions (tpy)
LNG Carrier Offloading	33	136	2	12	0.5
LNG Carrier Hotelling	6	27	0.4	2	0.1
LNG Carrier Transit	10	15	4	2	2
Assist Vessel Standby during Offloading/Hotelling	17	0.7	0.8	0.8	0.6
Assist Vessel Maneuvering/Pushing/Transit	28	0.9	2	2	1
Coast Guard Escort Vessels	4	0.09	115	0.03	3
Vessel Emissions at Berth	**56**	**163**	**3**	**15**	**1**
Total Vessel Emissions	98	180	124	18	8

1. Emissions presented are average annual emissions based on ship log data collected between August 3, 2004 and August 4, 2006.

Table 2. Estimated LNG Carrier Port Calls

Customer	LNG Carriers (ships/year)
Elba III Terminal Expansion, BG	61
Elba III Terminal Expansion, Shell	34
Cumulative Elba Island LNG Terminal, BG	145
Cumulative Elba Island LNG Terminal, Shell	76
Total Elba Island LNG Terminal	221

Table 3. BG Carrier Ship Emission Factors

Pollutant	Heavy Fuel Oil Emission Factor (ton/ton fuel)	Boil Off Gas Emission Factor (ton/ton fuel)
NO_X	0.0096	0.0077
SO_2	0.04	-
CO[2]	5.45E-04	0.0046
PM_{10}[2]	0.0034	3.80E-04
VOC[2]	1.36E-04	0.0023

2. Note that BG only provided emission factors for NO_X, SO_2, and CO_2. Factors for the remaining criteria pollutants were based on LNG carrier emissions provided by Shell. It was assumed that "Heavy Fuel Oil" combustion was equivalent to Shell's Heavy Fuel Oil (2.6% sulfur), and Boil Off Gas was equivalent to Shell's Dual duel (99% gas, 1% pilot diesel). Emission factors were estimated by dividing the emissions per port call for each pollutant by the mass of fuel combusted during hotelling and offloading operations.

Table 4. BG Carrier Ship Operations Summary

Mode	Duration (hours)	Heavy Fuel Oil Consumption (tons)	Fuel Gas Consumption (tons)
Approach Transit	2	2.65	7.28
Berthing Maneuvers	1	1.32	3.64
Offloading	14	69.45	-
Hotelling	6	7.72	-
Unberthing Maneuvers	0	-	-
Departure Transit	2	2.65	3.31

Table 5. Shell Carrier Ship Offloading and Hotelling Emission Factors

Engine (Approximate Calls/Year)	Fuel	Power in Mode per Call (kW)	Duration (hr)	NO_X Emission Factor (g/kW-hr)	SO_2 Emission Factor (g/kW-hr)	CO Emission Factor (g/kW-hr)	PM_{10} Emission Factor (g/kW-hr)	VOC Emission Factor (g/kW-hr)
Offloading								
Steam Turbine (3)	Heavy Fuel Oil	6,010	12	2.1	16.0	0.12	0.75	0.03
Med speed diesel (29)	LS DO	7,667	20	12.0	0.40	0.60	0.20	0.30
Med speed diesel (2)	Dual	6,010	12	1.3	0.005	0.60	0.05	0.30
Hotelling								
Steam Turbine (3)	Heavy Fuel Oil	1,900	8	2.1	16.0	0.1	0.8	0.0
Med speed diesel (29)	LS DO	3,117	8	12.0	0.40	0.60	0.20	0.30
Med speed diesel (2)	Dual	1,900	8	1.3	0.005	0.60	0.05	0.30

Table 6. Tug Assist Vessels Emission Factors and Operations Summary

Mode	Power in Mode per Call (kW)	Duration (min)	NO_X Emission Factor (g/kW-hr)	SO_2 Emission Factor (g/kW-hr)	CO Emission Factor (g/kW-hr)	PM_{10} Emission Factor[3] (g/kW-hr)	VOC Emission Factor[3] (g/kW-hr)
Navigation Assist Tugs (Varies)							
Running to/from Ship	2,852	550	9.43	0.361	0.771	0.720	0.500
Berthing Tug (4 Vessels)							
Maneuvering Around Ship	1,902	20	15.51	0.284	0.326	0.720	0.500
Maneuvering Around Ship/Easy Push	1,902	40	11.68	0.284	0.326	0.720	0.500
Pushing on Ship	3,803	60	9.31	0.271	0.578	0.720	0.500
Standby Tug (1 Vessel)							
Standby during Offloading/Hotelling	837	1,500	15.51	0.645	0.741	0.720	0.500
Pushing on Ship	3,803	0	-	-	-	-	-
Unberthing Tug (4 Vessels)							
Maneuvering Around Ship	2,852	40	9.43	0.361	0.771	0.720	0.500
Maneuvering Around Ship/Easy Push	1,902	60	11.68	0.542	1.157	0.720	0.500
Pulling on Ship	3,803	60	9.31	0.142	0.163	0.720	0.500

3. Note that vendor specific emission factors were only provided for NO_X, SO_2, and CO. PM_{10} and VOC emissions factors are based on Table 2-16 of ICF Consulting, *Current Methodologies and Best Practices in Preparing Port Emission Inventories* (Final Report). Prepared for the U.S. EPA Office of Policy, Economics, and Innovation. January 5, 2006.

Table 7. Coast Guard Escort Boats Emission Factors and Operations Summary[4]

Mode	Power in Mode per Call (hp)	Duration (min)	NO_X Emission Factor (g/hp-hr)	SO_2 Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)	PM_{10} Emission Factor (g/hp-hr)	VOC Emission Factor (g/hp-hr)
Primary Escort							
Running to/from Ship	400	270	8.952	0.204	258.1	0.06	7.46
Running with Ship	200	180	8.952	0.204	258.1	0.06	7.46
Patrol	80	1,800	8.952	0.204	258.1	0.06	7.46
Secondary Escort							
Running to/from Ship	400	270	8.952	0.204	258.1	0.06	7.46
Running with Ship	200	180	8.952	0.204	258.1	0.06	7.46
Running to/from Base	400	90	8.952	0.204	258.1	0.06	7.46

4. Coast Guard escort vessel emissions were based on factors for four-stroke outboard, precontrolled engines as presented in EPA's "Exhaust Emission Factors for Nonroad Engine Modeling – Spark Ignition."

Table 8. Indirect Emissions Summary (per call)

Vessel / Operation	NO_X Emissions (tons/call)	SO_2 Emissions (tons/call)	CO Emissions (tons/call)	PM_{10} Emissions (tons/call)	VOC Emissions (tons/call)
BG Carrier Ship					
Approach Transit	0.08	0.11	0.035	0.012	0.017
Berthing Maneuvers	0.041	0.053	0.017	0.006	0.008
Offloading	0.67	2.78	0.038	0.24	0.009
Hotelling	0.074	0.31	0.004	0.026	0.001
Unberthing Maneuvers	-	-	-	-	-
Departure Transit	0.051	0.11	0.017	0.010	0.008
Shell Carrier Ship					
Approach Transit	0.08	0.11	0.035	0.012	0.017
Berthing Maneuvers	0.041	0.053	0.017	0.006	0.008
Offloading	1.78	0.17	0.092	0.035	0.046
Hotelling	0.29	0.033	0.015	0.006	0.007
Unberthing Maneuvers	-	-	-	-	-
Departure Transit	0.051	0.11	0.017	0.010	0.008
Tug Assist Vessels Berthing					
Running to/from Ship	1.36E-01	5.20E-03	1.11E-02	1.04E-02	7.20E-03
Maneuvering Around Ship	1.08E-02	1.98E-04	2.28E-04	5.03E-04	3.49E-04
Maneuvering Around Ship/Easy Push	1.63E-02	3.97E-04	4.56E-04	1.01E-03	6.99E-04
Pushing on Ship	3.90E-02	1.14E-03	2.43E-03	3.02E-03	2.10E-03
Standby during Offloading/Hotelling	3.58E-01	1.49E-02	1.71E-02	1.66E-02	1.15E-02
Tug Assist Vessels Unberthing					
Running to/from Ship	1.36E-01	5.20E-03	1.11E-02	1.04E-02	7.20E-03
Maneuvering Around Ship	1.98E-02	7.57E-04	1.62E-03	1.51E-03	1.05E-03
Maneuvering Around Ship/Easy Push	2.45E-02	1.14E-03	2.43E-03	1.51E-03	1.05E-03
Pulling on Ship	3.90E-02	5.95E-04	6.83E-04	3.02E-03	2.10E-03
Primary Escort					
Running to/from Ship	1.78E-02	4.05E-04	5.12E-01	1.19E-04	1.48E-02
Running with Ship	5.92E-03	1.35E-04	1.71E-01	3.97E-05	4.93E-03
Patrol	2.37E-02	5.40E-04	6.83E-01	1.59E-04	1.97E-02
Secondary Escort					
Running to/from Ship	1.78E-02	4.05E-04	5.12E-01	1.19E-04	1.48E-02
Running with Ship	5.92E-03	1.35E-04	1.71E-01	3.97E-05	4.93E-03
Running to/from Base	5.92E-03	1.35E-04	1.71E-01	3.97E-05	4.93E-03
Totals					
BG Carrier Ships	0.91	3.35	0.11	0.29	0.04
Shell Carrier Ships	2.24	0.47	0.17	0.07	0.09
Tug Assist Vessels	0.78	0.03	0.05	0.05	0.03
Coast Guard Escort Boats	0.08	0.002	2.22	0.001	0.06

Table 9. Indirect Annual Emissions Summary

Vessel	NO_X Emissions (tpy)	SO_2 Emissions (tpy)	CO Emissions (tpy)	PM_{10} Emissions (tpy)	VOC Emissions (tpy)
BG Carrier Ships	132.5	485.9	16.0	42.2	6.4
Shell Carrier Ships	170.1	35.4	13.3	5.2	6.6
Tug Assist Vessels	172.1	6.5	10.4	10.6	7.4
Coast Guard Escort Boats	17.0	0.4	490.4	0.11	14.2
Total	**491.7**	**528.2**	**530.2**	**58.1**	**34.4**

Table 10. Determination of Secondary Emissions

Vessel / Operation	Included in Secondary Emissions?	Comments
Carrier Ship		
Approach/Departure Transit	No	"To and Fro" transit
Berthing/Unberthing Maneuvers	No	Mobile source vessel operation
Offloading	Yes	Activity associated with LNG offloading
Hotelling	Yes	Activity associated with LNG offloading
Tug Assist Vessels		
Running to/from Ship	No	"To and Fro" transit
Maneuvering Around Ship	No	"To and Fro" transit
Pushing/Pulling on Ship	No	Mobile source vessel operation
Standby during Offloading/Hotelling	Yes	Activity associated with LNG offloading
Coast Guard Escort Boats		
Running to/from Ship	No	"To and Fro" transit
Patrol while LNGC at berth	No	Mobile source vessel operation

Table 11. Summary of Secondary Emissions Following Elba III Terminal Expansion

	Cumulative Vessel Emissions due to Elba I, II, and III				
Operation	**NO_X Emissions** (tpy)	**SO_2 Emissions** (tpy)	**CO Emissions** (tpy)	**PM_{10} Emissions** (tpy)	**VOC Emissions** (tpy)
LNG Carrier Offloading	232	416	12	37	5
LNG Carrier Hotelling	32	47	2	4	0.7
LNG Carrier Transit	38	58	15	6	7
Assist Vessel Standby during Offloading/Hotelling	79	3	4	4	3
Assist Vessel Maneuvering/Pushing/Transit	93	3	7	7	5
Coast Guard Escort Vessels	17	0.4	490	0.1	14
Vessel Emissions at Berth	**343**	**466**	**18**	**45**	**8**
Total Vessel Emissions	492	528	530	58	34
	Elba III Vessel Emissions				
Operation	**NO_X Emissions** (tpy)	**SO_2 Emissions** (tpy)	**CO Emissions** (tpy)	**PM_{10} Emissions** (tpy)	**VOC Emissions** (tpy)
LNG Carrier Offloading	101	175	5	16	2
LNG Carrier Hotelling	14	20	0.8	2	0.3
LNG Carrier Transit	16	25	7	3	3
Assist Vessel Standby during Offloading/Hotelling	34	1	2	2	1
Assist Vessel Maneuvering/Pushing/Transit	40	1	3	3	2
Coast Guard Escort Vessels	7	0.2	211	0.05	6
Vessel Emissions at Berth	**149**	**197**	**8**	**19**	**4**
Total Vessel Emissions	213	223	228	25	15

Table 12. Estimated Emissions at Full Utilization of Elba I and II[5]

Vessel	**NO_X Emissions** (tpy)	**SO_2 Emissions** (tpy)	**CO Emissions** (tpy)	**PM_{10} Emissions** (tpy)	**VOC Emissions** (tpy)
LNG Carrier Offloading	131	240	7	21	3
LNG Carrier Hotelling	18	27	1	2	0.4
LNG Carrier Transit	22	33	9	4	4
Assist Vessel Standby during Offloading/Hotelling	45	2	2	2	1
Assist Vessel Maneuvering/Pushing/Transit	53	2	4	4	3
Coast Guard Escort Vessels	10	0.2	280	0.07	8
Vessel Emissions at Berth	**194**	**270**	**10**	**26**	**5**
Total Vessel Emissions	279	305	302	33	20

5. Equipment associated with the Elba II Terminal Expansion began operation in February 2006. Therefore, the actual emissions summary of 2004 - 2006 does not capture the capacity of the facility at full utilization of Elba I and II. This table presents an estimate of emissions when construction on Elba III would commence, assuming full utilization of Elba I and II (221 carriers cumulative minus 95 carriers associated with Elba III = 126 carriers for Elba I and II).

ATTACHMENT 4
Secondary Toxic Air Pollutant Supporting Documentation

TABLE 8-1. TOXIC AIR POLLUTANT AMBIENT IMPACT ASSESSMENT

Pollutant	Georgia Acceptable Ambient Concentrations			Air Quality Impacts			Toxic Air Pollutant Impact Assessment		
	Annual AAC ($\mu g/m^3$)	24-hour AAC ($\mu g/m^3$)	15-minute AAC ($\mu g/m^3$)	Annual Average ($\mu g/m^3$)	24-hour Average ($\mu g/m^3$)	15-minute Average ($\mu g/m^3$)	Annual AAC Compliance	24-hour AAC Compliance	15-minute AAC Compliance
HAPs:									
Acetaldehyde	4.55E+00	-	4.50E+03	2.52E-03	-	7.89E+00	Yes	-	Yes
Acrolein	2.00E-02	-	2.30E+01	1.53E-03	-	4.85E+00	Yes	-	Yes
Antimony	-	1.19E+00	-	-	2.83E-03	-	-	Yes	-
Arsenic	2.33E-04	-	2.00E-01	3.00E-05	-	4.69E-03	Yes	-	Yes
Benzene	1.28E-01	-	1.60E+03	9.50E-04	-	4.15E-01	Yes	-	Yes
Beryllium	4.17E-03	-	5.00E-01	0.00E+00	-	1.45E-04	Yes	-	Yes
1,3-Butadiene	3.57E-02	-	1.11E+03	2.40E-04	-	2.52E-01	Yes	-	Yes
Cadmium	5.56E-03	-	3.00E+01	1.60E-04	-	1.29E-02	Yes	-	Yes
Carbon Tetrachloride	6.67E-01	-	1.57E+04	1.00E-05	-	3.47E-02	Yes	-	Yes
Chlorobenzene	-	8.33E+02	-	-	1.28E-03	-	-	Yes	-
Chloroform	4.35E-01	-	2.40E+04	1.00E-05	-	2.69E-02	Yes	-	Yes
Chromium	-	2.38E+00	-	-	2.06E-03	-	-	Yes	-
Chromium (VI)	8.33E-05	-	1.00E+01	0.00E+00	-	8.84E-04	Yes	-	Yes
Cobalt	-	2.38E-01	-	-	3.27E-03	-	-	Yes	-
Dichlorobenzene	8.00E+02	-	-	1.70E-04	-	-	Yes	-	-
1,3-Dichloropropene	2.50E+00	-	-	1.00E-05	-	-	Yes	-	-
Ethylbenzene	1.00E+03	-	5.43E+04	6.00E-04	-	4.12E-02	Yes	-	Yes
Ethylene Dibromide	4.55E-02	-	2.50E+04	1.00E-05	-	4.18E-02	Yes	-	Yes
Ethylene Dichloride	3.85E-01	-	4.05E+04	1.00E-05	-	2.23E-02	Yes	-	Yes
Ethylidene Dichloride	-	9.52E+02	-	-	9.90E-04	-	-	Yes	-
Formaldehyde	7.69E-01	-	2.45E+02	1.70E-02	-	4.99E+01	Yes	-	Yes
n-Hexane	2.00E+02	-	-	1.53E-03	-	-	Yes	-	-
Lead	-	1.19E-01	-	-	1.06E-03	-	-	Yes	-
Manganese	5.00E-02	-	5.00E+02	7.00E-05	-	1.07E-02	Yes	-	Yes
Mercury	3.00E-01	-	1.00E+01	4.00E-05	-	3.05E-03	Yes	-	Yes
Methanol	-	6.19E+02	3.28E+04	-	6.44E-01	5.20E+00	-	Yes	Yes
Methylene Chloride	2.13E+01	-	4.34E+04	1.00E-05	-	1.89E-02	Yes	-	Yes
Nickel	4.17E-03	-	-	6.30E-04	-	-	Yes	-	-
Phenol	-	4.52E+01	6.00E+03	-	1.79E-03	2.27E-02	-	Yes	Yes
Propylene Oxide	2.70E+00	-	-	1.00E-04	-	-	Yes	-	-
Selenium	-	4.76E-01	-	-	3.70E-04	-	-	Yes	-
Styrene	1.00E+03	-	8.52E+04	1.32E-03	-	1.11E-01	Yes	-	Yes
1,1,2,2-Tetrachloroethane	5.80E-01	-	-	1.00E-05	-	-	Yes	-	-
Toluene	4.00E+02	-	1.13E+05	2.46E-03	-	3.85E-01	Yes	-	Yes
1,1,2-Trichloroethane	1.60E-01	-	-	1.00E-05	-	-	Yes	-	-
Trimethylamine	-	2.86E+01	3.60E+03	-	0.00E+00	0.00E+00	-	Yes	Yes
2,2,4-Trimethylpentane	-	3.45E+02	-	-	7.11E-02	-	-	Yes	-
Vinyl Chloride	2.27E-01	-	1.39E+03	0.00E+00	-	1.41E-02	Yes	-	Yes
Xylenes	1.00E+02	-	6.51E+04	1.71E-03	-	1.74E-01	Yes	-	Yes
Polycyclic Organic Matter:									
Acenaphthene	-	4.14E+01	-	-	2.20E-04	-	-	Yes	-
Acenaphthylene	-	1.17E+02	-	-	3.90E-04	-	-	Yes	-
Anthracene	-	4.76E-01	-	-	1.40E-04	-	-	Yes	-
Benz(a)anthracene	-	1.38E+01	-	-	1.20E-04	-	-	Yes	-
Benzo(a)pyrene	-	4.76E-01	-	-	9.00E-05	-	-	Yes	-
Benzo(e)pyrene	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	4.76E-01	-	-	2.00E-04	-	-	Yes	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	4.76E-01	-	-	6.40E-04	-	-	Yes	-
Biphenyl	-	2.38E+00	-	-	1.14E-02	-	-	Yes	-
Chrysene	-	4.76E-01	-	-	1.70E-04	-	-	Yes	-
Dibenz(a,h)anthracene	-	1.61E+01	-	-	1.40E-04	-	-	Yes	-
Fluoranthene	-	4.76E-01	-	-	2.50E-04	-	-	Yes	-
Fluorene	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-c)pyrene	-	4.76E-01	-	-	1.50E-04	-	-	Yes	-
2-Methylnaphthalene	-	1.13E+02	-	-	1.43E-03	-	-	Yes	-
Naphthalene	3.00E+00	-	7.90E+03	1.40E-04	-	7.03E-02	Yes	-	Yes
Phenanthrene	-	4.76E-01	-	-	1.72E-03	-	-	Yes	-
Pyrene	-	4.76E-01	-	-	2.20E-04	-	-	Yes	-
Non-HAPs:									
Acetylene	-	-	2.66E+05	-	-	6.40E+01	-	-	Yes
Barium	-	1.19E+00	-	-	6.45E-03	-	-	Yes	-
Butane	-	4.52E+03	-	-	2.04E+00	-	-	Yes	-
Butyraldehyde	-	1.72E+02	-	-	1.71E-02	-	-	Yes	-
Chloroethane	1.00E+04	-	-	6.93E-03	-	-	Yes	-	-
Copper	-	2.38E-01	-	-	1.64E-03	-	-	Yes	-
Cyclohexane	-	2.50E+03	1.38E+05	-	1.04E-01	5.60E-01	-	Yes	Yes
Cyclopentane	-	4.10E+03	-	-	7.37E-02	-	-	Yes	-
Ethane	-	-	-	-	-	-	-	-	-
Ethylene	-	-	-	-	-	-	-	-	-
Flourides (as F)	-	5.95E+00	-	-	2.01E-02	-	-	Yes	-
Isobutane	-	4.52E+03	-	-	5.46E-02	-	-	Yes	-
Methane	-	-	-	-	-	-	-	-	-
Methylcyclohexane	-	4.76E+03	-	-	3.11E-01	-	-	Yes	-
Molybdenum	-	1.19E+01	-	-	1.70E-03	-	-	Yes	-
n-Nonane	-	2.50E+03	-	-	2.98E-02	-	-	Yes	-
n-Octane	-	5.60E+03	1.80E+05	-	1.07E-01	6.72E-01	-	Yes	Yes
n-Pentane	-	7.02E+03	1.80E+05	-	3.25E+00	2.39E+01	-	Yes	Yes
Phosphorus	-	2.38E-01	-	-	5.11E-03	-	-	Yes	-
Propanal	-	1.19E+03	6.14E+04	-	9.52E-03	5.65E-02	-	Yes	Yes
Propane	-	4.29E+03	-	-	2.29E+00	-	-	Yes	-
Propylene	-	-	-	-	-	-	-	-	-
Propylene Dichloride	4.00E+00	-	5.08E+04	1.00E-05	-	2.54E-02	Yes	-	Yes
1,2,3-Trimethylbenzene	-	2.93E+02	-	-	2.46E-02	-	-	Yes	-
1,2,4-Trimethylbenzene	-	2.93E+02	-	-	2.46E-02	-	-	Yes	-
1,3,5-Trimethylbenzene	-	2.93E+02	-	-	4.09E-02	-	-	Yes	-
Vanadium	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-

Table 1. BG Carrier Ship Operations Summary

Mode	Duration (hours)	Heavy Fuel Oil Consumption (tons)	(gal)[1]
Offloading	14	69.45	17,626
Hotelling	6	7.72	1,958

1. Fuel consumption converted from mass to volume based on No. 6 Fuel Oil density of 7.88 lb/gal (AP-42, Table 1.3-12).

Table 2. Shell Carrier Ship Offloading and Hotelling Operations Summary

Engine (Approximate Calls/Year)	Fuel	Power in Mode per Call (kW)	Duration (hr)	Fuel Usage per Call[2,3] (tons)	Fuel Usage per Call[1,4] (gal)
Offloading					
Steam Turbine (3)	Heavy Fuel Oil	6,010	12	23.57	5,983
Med speed diesel (29)	LS DO	7,667	20	30.90	8,765
Med speed diesel (2)	Dual	6,010	12	14.71	4,172
Hotelling					
Steam Turbine (3)	Heavy Fuel Oil	1,900	8	5.11	1,297
Med speed diesel (29)	LS DO	3,117	8	4.95	1,404
Med speed diesel (2)	Dual	1,900	8	3.02	856

2. Steam Turbine fuel use based on engine flow rate of 305 g/kW-hr.
3. Medium speed diesel fuel use based on engine flow rate of 180 g/kW-hr.
4. Fuel consumption converted from mass to volume based on No. 2 Fuel Oil density of 7.05 lb/gal (AP-42, Table 1.3-12).

Table 3. Tug Assist Vessels Operations Summary

Mode	Power in Mode per Call (kW)	Duration (min)	Fuel Usage per Call[5,6] (gal)
Standby Tug (1 Vessel)			
Standby during Offloading/Hotelling	837	1,500	2,039

5. Power output converted to fuel input based on an assumed efficiency of 25% for IC engines.
6. Fuel throughput converted to a volume basis using an average heat content of 140,000 BTU/gal for No. 2 fuel oil.

Table 4. Estimated LNG Carrier Port Calls

Customer	LNG Carriers (ships/year)
Elba III Terminal Expansion, BG	61
Elba III Terminal Expansion, Shell	34
Cumulative Elba Island LNG Terminal, BG	145
Cumulative Elba Island LNG Terminal, Shell	76
Total Elba Island LNG Terminal	221

Table 5. Emission Factor Summary

Vessel	Emission Factor Source	Table(s)	Fuel
BG Carrier Ship	AP-42, Section 1.3	1.3-8, 1.3-9, 1.3-11	No. 6 Fuel Oil
Shell Carrier, Steam Turbine	AP-42, Section 1.3	1.3-8, 1.3-9, 1.3-11	No. 6 Fuel Oil
Shell Carrier, Med Speed Diesel	AP-42, Section 3.4	3.4-3, 3.4-4	No. 2 Fuel Oil
Tug Assist Vessel	AP-42, Section 3.4	3.4-3, 3.4-4	No. 2 Fuel Oil

Table 6. Indirect Emissions Summary (per call)[7,8]

Toxic Pollutants	BG Carrier (lbs/call)	Shell Carrier - Steam Turbine (lbs/call)	Shell Carrier - LS DO Medium Speed (lbs/call)	Shell Carrier - Dual Fuel Medium Speed (lbs/call)	Tug Assist - Standy during Offloading/Hotelling (lbs/call)
Acetaldehyde	-	-	3.59E-02	1.77E-02	7.19E-03
Acrolein	-	-	1.12E-02	5.55E-03	2.25E-03
Antimony	1.03E-01	3.82E-02	-	-	-
Arsenic	2.59E-02	9.61E-03	-	-	-
Benzene	4.19E-03	1.56E-03	1.10E+00	5.46E-01	2.22E-01
Beryllium	5.44E-04	2.02E-04	-	-	-
1,3-Butadiene	-	-	-	-	-
Cadmium	7.79E-03	2.90E-03	-	-	-
Carbon Tetrachloride	-	-	-	-	-
Chlorobenzene	-	-	-	-	-
Chloroform	-	-	-	-	-
Chromium Compounds	1.65E-02	6.15E-03	-	-	-
Chromium (VI)	4.86E-03	1.81E-03	-	-	-
Cobalt	1.18E-01	4.38E-02	-	-	-
Dichlorobenzene	-	-	-	-	-
1,3-Dichloropropene	-	-	-	-	-
Ethylbenzene	1.25E-03	4.63E-04	-	-	-
Ethylene Dibromide	-	-	-	-	-
Etheylene Dichloride	-	-	-	-	-
Ethylidene Dichloride	-	-	-	-	-
Formaldehyde	1.19E+00	4.44E-01	1.12E-01	5.55E-02	2.25E-02
n-Hexane	-	-	-	-	-
Lead Compounds	2.96E-02	1.10E-02	-	-	-
Manganese Compounds	5.88E-02	2.18E-02	-	-	-
Mercury Compounds	2.21E-03	8.23E-04	-	-	-
Methanol	-	-	-	-	-
Methylene Chloride	-	-	-	-	-
Nickel Compounds	1.65E+00	6.15E-01	-	-	-
Phenol	-	-	-	-	-
Propylene Oxide	-	-	-	-	-
Selenium Compounds	1.34E-02	4.97E-03	-	-	-
Styrene	-	-	-	-	-
1,1,2-2-Tetracholorethane	-	-	-	-	-
Toluene	1.21E-01	4.51E-02	4.00E-01	1.98E-01	8.02E-02
1,1,2-Trichloroethane	4.62E-03	1.72E-03	-	-	-
Trimethlyamine	-	-	-	-	-
2,2,4-Trimethylpentane	-	-	-	-	-
Vinyl Chloride	-	-	-	-	-
Xylenes	2.13E-03	7.94E-04	2.75E-01	1.36E-01	5.51E-02
Acenaphthene	4.13E-04	1.54E-04	6.66E-03	3.29E-03	1.34E-03
Acenaphthylene	4.95E-06	1.84E-06	1.31E-02	6.50E-03	2.63E-03
Anthracene	2.39E-05	8.88E-06	1.75E-03	8.66E-04	3.51E-04
Benz(a)anthracene	7.85E-05	2.92E-05	8.86E-04	4.38E-04	1.78E-04
Benzo(a)pyrene	-	-	3.66E-04	1.81E-04	7.34E-05
Benzo(e)pyrene	-	-	-	-	-
Benzo(b)fluoranthene	2.90E-05	1.08E-05	1.58E-03	7.81E-04	3.17E-04
Benzo(g,h,i)perylene	4.43E-05	1.65E-05	7.92E-04	3.91E-04	1.59E-04
Benzo(k)fluoranthene	2.90E-05	1.08E-05	3.10E-04	1.53E-04	6.22E-05
Biphenyl	-	-	-	-	-
Chrysene	4.66E-05	1.73E-05	2.18E-03	1.08E-03	4.37E-04
Dibenz(a,h)anthracene	3.27E-05	1.22E-05	4.93E-04	2.44E-04	9.88E-05
Fluoranthene	9.48E-05	3.52E-05	5.74E-03	2.84E-03	1.15E-03
Fluorene	8.75E-05	3.25E-05	1.82E-02	9.01E-03	3.65E-03
Ideno(1,2,3-c)pyrene	4.19E-05	1.56E-05	5.89E-04	2.91E-04	1.18E-04
2-Methylnaphthalene	-	-	-	-	-
Naphthalene	2.21E-02	8.23E-03	1.85E-01	9.15E-02	3.71E-02
Phenanthrene	2.06E-04	7.64E-05	5.81E-02	2.87E-02	1.16E-02
Pyrene	8.32E-05	3.09E-05	5.28E-03	2.61E-03	1.06E-03
Total PAH	-	-	3.02E-01	1.49E-01	6.05E-02
Total POM	-	-	-	-	-
Acetylene	-	-	-	-	-
Barium Compounds	5.03E-02	1.87E-02	-	-	-
Butane	-	-	-	-	-
Iso/Butyrladehyde	-	-	-	-	-
Chloroethane	-	-	-	-	-
Copper Compounds	3.45E-02	1.28E-02	-	-	-
Cyclohexane	-	-	-	-	-
Cyclopentane	-	-	-	-	-
Ethane	-	-	-	-	-
Ethylene	-	-	-	-	-
Flourides (as F)	7.30E-01	2.72E-01	-	-	-
Isobutane	-	-	-	-	-
Methane	1.96E+01	7.28E+00	8.54E+02	4.22E+02	1.71E+02
Methylcyclohexane	-	-	-	-	-
Molybdenum Compounds	1.54E-02	5.73E-03	-	-	-
n-Nonane	-	-	-	-	-
n-Octane	-	-	-	-	-
n-Pentane	-	-	-	-	-
Phosphorus	1.85E-01	6.89E-02	-	-	-
Propanal	-	-	-	-	-
Propane	-	-	-	-	-
Propylene	-	-	3.97E+00	1.96E+00	7.96E-01
Propylene Dichloride	-	-	-	-	-
1,2,3-Trimethylbenzene	-	-	-	-	-
1,2,4-Trimethylbenzene	-	-	-	-	-
1,3,5-Trimethylbenzene	-	-	-	-	-
Vanadium Compounds	6.23E-01	2.32E-01	-	-	-
Zinc Compounds	5.70E-01	2.12E-01	-	-	-

7. BG and Shell-Turbine estimates based on an avg heat content of 150 MMBTU/Mgal for No. 6 fuel oil.
8. Shell-Med Speed Diesel and Tug Assist estimates based on an avg heat content of 140 MMBTU/Mgal for No. 2 fuel oil.

Table 7. Short Term Toxics Emission Rates (lbs/hr)

Toxic Pollutants	BG Carrier (lb/hr)	Shell Carrier - Steam Turbine (lb/hr)	Shell Carrier - LS DO Medium Speed (lb/hr)	Shell Carrier - Dual Fuel Medium Speed (lb/hr)	Tug Assist - Standy during Offloading/Hotelling (lb/hr)	LNG Carrier Maximum Rate (lb/hr)
Acetaldehyde	0.00E+00	0.00E+00	1.52E-03	1.19E-03	2.88E-04	1.52E-03
Acrolein	0.00E+00	0.00E+00	4.76E-04	3.73E-04	9.00E-05	4.76E-04
Antimony	6.61E-03	2.69E-03	0.00E+00	0.00E+00	0.00E+00	6.61E-03
Arsenic	1.66E-03	6.77E-04	0.00E+00	0.00E+00	0.00E+00	1.66E-03
Benzene	2.69E-04	1.10E-04	4.69E-02	3.68E-02	8.86E-03	4.69E-02
Beryllium	3.50E-05	1.43E-05	0.00E+00	0.00E+00	0.00E+00	3.50E-05
1,3-Butadiene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium	5.01E-04	2.04E-04	0.00E+00	0.00E+00	0.00E+00	5.01E-04
Carbon Tetrachloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chloroform	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromium Compounds	1.06E-03	4.33E-04	0.00E+00	0.00E+00	0.00E+00	1.06E-03
Chromium (VI)	3.12E-04	1.27E-04	0.00E+00	0.00E+00	0.00E+00	3.12E-04
Cobalt	7.58E-03	3.09E-03	0.00E+00	0.00E+00	0.00E+00	7.58E-03
Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-Dichloropropene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	8.01E-05	3.26E-05	0.00E+00	0.00E+00	0.00E+00	8.01E-05
Ethylene Dibromide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Etheylene Dichloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylidene Dichloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde	7.68E-02	3.13E-02	4.77E-03	3.74E-03	9.01E-04	7.68E-02
n-Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Lead Compounds	1.90E-03	7.74E-04	0.00E+00	0.00E+00	0.00E+00	1.90E-03
Manganese Compounds	3.78E-03	1.54E-03	0.00E+00	0.00E+00	0.00E+00	3.78E-03
Mercury Compounds	1.42E-04	5.80E-05	0.00E+00	0.00E+00	0.00E+00	1.42E-04
Methanol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methylene Chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel Compounds	1.06E-01	4.33E-02	0.00E+00	0.00E+00	0.00E+00	1.06E-01
Phenol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Propylene Oxide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium Compounds	8.60E-04	3.50E-04	0.00E+00	0.00E+00	0.00E+00	8.60E-04
Styrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,1,2-2-Tetracholorethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	7.81E-03	3.18E-03	1.70E-02	1.33E-02	3.21E-03	1.70E-02
1,1,2-Trichloroethane	2.97E-04	1.21E-04	0.00E+00	0.00E+00	0.00E+00	2.97E-04
Trimethlyamine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Vinyl Chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xylenes	1.37E-04	5.59E-05	1.17E-02	9.14E-03	2.20E-03	1.17E-02
Acenaphthene	2.66E-05	1.08E-05	2.83E-04	2.22E-04	5.34E-05	2.83E-04
Acenaphthylene	3.19E-07	1.30E-07	5.58E-04	4.37E-04	1.05E-04	5.58E-04
Anthracene	1.54E-06	6.26E-07	7.43E-05	5.83E-05	1.40E-05	7.43E-05
Benz(a)anthracene	5.05E-06	2.06E-06	3.76E-05	2.95E-05	7.10E-06	3.76E-05
Benzo(a)pyrene	0.00E+00	0.00E+00	1.55E-05	1.22E-05	2.93E-06	1.55E-05
Benzo(e)pyrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	1.86E-06	7.59E-07	6.71E-05	5.26E-05	1.27E-05	6.71E-05
Benzo(g,h,i)perylene	2.85E-06	1.16E-06	3.36E-05	2.63E-05	6.35E-06	3.36E-05
Benzo(k)fluoranthene	1.86E-06	7.59E-07	1.32E-05	1.03E-05	2.49E-06	1.32E-05
Biphenyl	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chrysene	3.00E-06	1.22E-06	9.24E-05	7.25E-05	1.75E-05	9.24E-05
Dibenz(a,h)anthracene	2.10E-06	8.56E-07	2.09E-05	1.64E-05	3.95E-06	2.09E-05
Fluoranthene	6.09E-06	2.48E-06	2.43E-04	1.91E-04	4.60E-05	2.43E-04
Fluorene	5.63E-06	2.29E-06	7.73E-04	6.06E-04	1.46E-04	7.73E-04
Ideno(1,2,3-c)pyrene	2.69E-06	1.10E-06	2.50E-05	1.96E-05	4.73E-06	2.50E-05
2-Methylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Naphthalene	1.42E-03	5.80E-04	7.85E-03	6.16E-03	1.48E-03	7.85E-03
Phenanthrene	1.32E-05	5.38E-06	2.47E-03	1.93E-03	4.66E-04	2.47E-03
Pyrene	5.35E-06	2.18E-06	2.24E-04	1.76E-04	4.24E-05	2.24E-04
Total PAH	0.00E+00	0.00E+00	1.28E-02	1.00E-02	2.42E-03	1.28E-02
Total POM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Barium Compounds	3.24E-03	1.32E-03	0.00E+00	0.00E+00	0.00E+00	3.24E-03
Butane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iso/Butyrladehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper Compounds	2.22E-03	9.03E-04	0.00E+00	0.00E+00	0.00E+00	2.22E-03
Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cyclopentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Flourides (as F)	4.70E-02	1.91E-02	0.00E+00	0.00E+00	0.00E+00	4.70E-02
Isobutane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methane	1.26E+00	5.13E-01	3.63E+01	2.84E+01	6.85E+00	3.63E+01
Methylcyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Molybdenum Compounds	9.91E-04	4.04E-04	0.00E+00	0.00E+00	0.00E+00	9.91E-04
n-Nonane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
n-Octane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
n-Pentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phosphorus	1.19E-02	4.85E-03	0.00E+00	0.00E+00	0.00E+00	1.19E-02
Propanal	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Propane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Propylene	0.00E+00	0.00E+00	1.69E-01	1.32E-01	3.19E-02	1.69E-01
Propylene Dichloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,4-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Vanadium Compounds	4.00E-02	1.63E-02	0.00E+00	0.00E+00	0.00E+00	4.00E-02
Zinc Compounds	3.66E-02	1.49E-02	0.00E+00	0.00E+00	0.00E+00	3.66E-02

Table 8. Cumulative Elba I, II and III Annual Toxics Emission Rates (tpy)

Toxic Pollutants	BG Carrier (tpy)	Shell Carrier - Steam Turbine (tpy)	Shell Carrier - LS DO Medium Speed (tpy)	Shell Carrier - Dual Fuel Medium Speed (tpy)	Tug Assist - Standy during Offloading/Hotelling (tpy)	LNG Carrier Total (tpy)
Acetaldehyde	0.00E+00	0.00E+00	1.16E-03	3.97E-05	7.95E-04	1.20E-03
Acrolein	0.00E+00	0.00E+00	3.64E-04	1.24E-05	2.49E-04	3.76E-04
Antimony	7.45E-03	1.28E-04	0.00E+00	0.00E+00	0.00E+00	7.58E-03
Arsenic	1.87E-03	3.22E-05	0.00E+00	0.00E+00	0.00E+00	1.91E-03
Benzene	3.04E-04	5.22E-06	3.58E-02	1.22E-03	2.45E-02	3.73E-02
Beryllium	3.95E-05	6.79E-07	0.00E+00	0.00E+00	0.00E+00	4.02E-05
1,3-Butadiene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium	5.65E-04	9.72E-06	0.00E+00	0.00E+00	0.00E+00	5.75E-04
Carbon Tetrachloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chloroform	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromium Compounds	1.20E-03	2.06E-05	0.00E+00	0.00E+00	0.00E+00	1.22E-03
Chromium (VI)	3.52E-04	6.05E-06	0.00E+00	0.00E+00	0.00E+00	3.58E-04
Cobalt	8.55E-03	1.47E-04	0.00E+00	0.00E+00	0.00E+00	8.69E-03
Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-Dichloropropene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	9.03E-05	1.55E-06	0.00E+00	0.00E+00	0.00E+00	9.19E-05
Ethylene Dibromide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Etheylene Dichloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylidene Dichloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde	8.66E-02	1.49E-03	3.64E-03	1.24E-04	2.49E-03	9.19E-02
n-Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Lead Compounds	2.14E-03	3.69E-05	0.00E+00	0.00E+00	0.00E+00	2.18E-03
Manganese Compounds	4.26E-03	7.32E-05	0.00E+00	0.00E+00	0.00E+00	4.33E-03
Mercury Compounds	1.60E-04	2.76E-06	0.00E+00	0.00E+00	0.00E+00	1.63E-04
Methanol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methylene Chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel Compounds	1.20E-01	2.06E-03	0.00E+00	0.00E+00	0.00E+00	1.22E-01
Phenol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Propylene Oxide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium Compounds	9.70E-04	1.67E-05	0.00E+00	0.00E+00	0.00E+00	9.86E-04
Styrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,1,2-2-Tetracholorethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	8.80E-03	1.51E-04	1.30E-02	4.42E-04	8.86E-03	2.24E-02
1,1,2-Trichloroethane	3.35E-04	5.76E-06	0.00E+00	0.00E+00	0.00E+00	3.41E-04
Trimethlyamine	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,2,4-Trimethylpentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Vinyl Chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xylenes	1.55E-04	2.66E-06	8.91E-03	3.04E-04	6.09E-03	9.37E-03
Acenaphthene	3.00E-05	5.15E-07	2.16E-04	7.36E-06	1.48E-04	2.54E-04
Acenaphthylene	3.59E-07	6.18E-09	4.26E-04	1.45E-05	2.91E-04	4.41E-04
Anthracene	1.73E-06	2.98E-08	5.68E-05	1.94E-06	3.88E-05	6.05E-05
Benz(a)anthracene	5.69E-06	9.79E-08	2.87E-05	9.79E-07	1.96E-05	3.55E-05
Benzo(a)pyrene	0.00E+00	0.00E+00	1.19E-05	4.04E-07	8.11E-06	1.23E-05
Benzo(e)pyrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	2.10E-06	3.61E-08	5.12E-05	1.75E-06	3.50E-05	5.51E-05
Benzo(g,h,i)perylene	3.21E-06	5.52E-08	2.57E-05	8.75E-07	1.75E-05	2.98E-05
Benzo(k)fluoranthene	2.10E-06	3.61E-08	1.01E-05	3.43E-07	6.88E-06	1.25E-05
Biphenyl	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chrysene	3.38E-06	5.81E-08	7.06E-05	2.41E-06	4.83E-05	7.64E-05
Dibenz(a,h)anthracene	2.37E-06	4.08E-08	1.60E-05	5.44E-07	1.09E-05	1.89E-05
Fluoranthene	6.87E-06	1.18E-07	1.86E-04	6.34E-06	1.27E-04	1.99E-04
Fluorene	6.35E-06	1.09E-07	5.91E-04	2.01E-05	4.04E-04	6.17E-04
Ideno(1,2,3-c)pyrene	3.04E-06	5.22E-08	1.91E-05	6.51E-07	1.31E-05	2.28E-05
2-Methylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Naphthalene	1.60E-03	2.76E-05	6.00E-03	2.05E-04	4.10E-03	7.84E-03
Phenanthrene	1.49E-05	2.56E-07	1.88E-03	6.42E-05	1.29E-03	1.96E-03
Pyrene	6.03E-06	1.04E-07	1.71E-04	5.84E-06	1.17E-04	1.83E-04
Total PAH	0.00E+00	0.00E+00	9.78E-03	3.34E-04	6.69E-03	1.01E-02
Total POM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Barium Compounds	3.65E-03	6.27E-05	0.00E+00	0.00E+00	0.00E+00	3.71E-03
Butane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iso/Butyrladehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper Compounds	2.50E-03	4.30E-05	0.00E+00	0.00E+00	0.00E+00	2.54E-03
Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cyclopentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Flourides (as F)	5.30E-02	9.10E-04	0.00E+00	0.00E+00	0.00E+00	5.39E-02
Isobutane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methane	1.42E+00	2.44E-02	2.77E+01	9.44E-01	1.89E+01	3.01E+01
Methylcyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Molybdenum Compounds	1.12E-03	1.92E-05	0.00E+00	0.00E+00	0.00E+00	1.14E-03
n-Nonane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
n-Octane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
n-Pentane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phosphorus	1.34E-02	2.31E-04	0.00E+00	0.00E+00	0.00E+00	1.37E-02
Propanal	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Propane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Propylene	0.00E+00	0.00E+00	1.29E-01	4.39E-03	8.80E-02	1.33E-01
Propylene Dichloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,3-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,4-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-Trimethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Vanadium Compounds	4.52E-02	7.76E-04	0.00E+00	0.00E+00	0.00E+00	4.59E-02
Zinc Compounds	4.13E-02	7.10E-04	0.00E+00	0.00E+00	0.00E+00	4.20E-02

ATTACHMENT 5
VISCREEN Plume Visibility Screening Analysis
Output Files

Visual Effects Screening Analysis for
Source: Elba Island LNG Terminal
Class I Area: BCA

*** Level-1 Screening ***

Input Emissions for

Particulates	60.40	TON/YR
NOx (as NO2)	980.00	TON/YR
Primary NO2	.00	TON/YR
Soot	.00	TON/YR
Primary SO4	.00	TON/YR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	25.00 km
Source-Observer Distance:	49.10 km
Min. Source-Class I Distance:	49.10 km
Max. Source-Class I Distance:	50.10 km
Plume-Source-Observer Angle:	11.25 degrees

Stability: 6
Wind Speed: 1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	49.1	84.	2.00	.783	.05	-.002
SKY	140.	84.	49.1	84.	2.00	.251	.05	-.005
TERRAIN	10.	84.	49.1	84.	2.00	.075	.05	.001
TERRAIN	140.	84.	49.1	84.	2.00	.023	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	45.8	104.	2.00	.826	.05	-.003
SKY	140.	65.	45.8	104.	2.00	.264	.05	-.005
TERRAIN	10.	55.	43.9	114.	2.00	.102	.05	.001
TERRAIN	140.	55.	43.9	114.	2.00	.032	.05	.001

Dispersion Condition	$\sigma_z \times \upsilon$ (m^2/s)	Transport Time (hr)	Include? (yes/no)	Maximum Year of Five Years = 1986 Occurrence Frequency (%) 1-6	7-12	13-18	19-24	Worst-Case Cumulative Frequency 0-24 (%)
F,1	76	15.6	No	-	-	-	-	0.00
E,1	133	15.6	No	-	-	-	-	0.00
F,2	152	5.2	Yes	0.25	-	-	0.18	0.25
D,1	252	15.6	No	-	-	-	-	0.25
F,3	229	3.1	Yes	0.83	0.01	-	0.27	1.08
E,2	266	5.2	Yes	0.01	-	-	0.01	1.10
E,3	399	3.1	Yes	0.15	0.07	-	0.14	1.24
D,2	503	5.2	Yes	-	0.06	-	-	1.30
E,4	532	2.2	Yes	0.37	0.06	0.01	0.29	1.67
E,5	665	1.7	Yes	0.09	0.01	-	0.14	1.80
D,3	755	3.1	Yes	0.03	0.18	0.03	0.02	1.99
D,4	1,006	2.2	Yes	0.15	0.16	0.07	0.10	2.15
D,5	1,258	1.7	Yes	0.10	0.14	0.09	0.14	2.28
D,6	1,509	1.4	Yes	0.01	0.13	0.16	0.13	2.44
D,7	1,761	1.2	Yes	0.01	0.10	0.14	0.06	2.58
C,2	2,578	5.2	Yes	-	0.02	-	-	2.60
D,8	2,012	1.0	Yes	-	0.02	0.02	0.01	2.63
B,1	4,233	15.6	No	-	-	-	-	2.63
C,3	3,867	3.1	Yes	-	0.05	0.01	-	2.67
C,4	5,156	2.2	Yes	-	0.09	0.06	-	2.76
C,5	6,445	1.7	Yes	-	0.18	0.18	-	2.95
B,2	8,465	5.2	Yes	-	0.02	0.01	-	2.97
C,6	7,734	1.4	Yes	-	0.05	0.10	-	3.07
C,7	9,023	1.2	Yes	-	-	-	-	3.07
C,8	10,312	1.0	Yes	-	-	-	-	3.07
B,3	12,698	3.1	Yes	-	0.06	0.05	-	3.13
A,1	5,000	15.6	No	-	-	-	-	3.13
C,9	11,600	0.9	Yes	-	-	-	-	3.13
C,10	12,889	0.8	Yes	-	-	-	-	3.13
C,11	14,178	0.7	Yes	-	-	-	-	3.13
B,4	16,930	2.2	Yes	-	0.03	0.10	-	3.23
C,12	15,467	0.7	Yes	-	-	-	-	3.23
B,5	21,163	1.7	Yes	-	0.05	0.05	-	3.28
A,2	10,000	5.2	Yes	-	-	0.01	-	3.29

Visual Effects Screening Analysis for
Source: Elba Island LNG Terminal
Class I Area: FMHP

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	60.40	TON/YR
NOx (as NO2)	980.00	TON/YR
Primary NO2	.00	TON/YR
Soot	.00	TON/YR
Primary SO4	.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone: .04 ppm
Background Visual Range: 25.00 km
Source-Observer Distance: 29.00 km
Min. Source-Class I Distance: 29.00 km
Max. Source-Class I Distance: 30.00 km
Plume-Source-Observer Angle: 11.25 degrees
Stability: 6
Wind Speed: 3.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	29.0	84.	2.00	.836	.05	-.002
SKY	140.	84.	29.0	84.	2.00	.275	.05	-.004
TERRAIN	10.	84.	29.0	84.	2.00	.160	.05	.002
TERRAIN	140.	84.	29.0	84.	2.00	.053	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	27.1	104.	2.00	.848	.05	-.002
SKY	140.	65.	27.1	104.	2.00	.278	.05	-.004
TERRAIN	10.	50.	25.3	119.	2.00	.198	.05	.002
TERRAIN	140.	50.	25.3	119.	2.00	.066	.05	.002

Dispersion Condition	$\sigma_z \times \upsilon$ (m^2/s)	Transport Time (hr)	Include? (yes/no)	Maximum Year of Five Years = 1982 1-6	7-12	13-18	19-24	Worst-Case Cumulative Frequency 0-24 (%)
				Occurrence Frequency (%)				
F,1	80	17.5	No	-	-	-	-	0.00
E,1	141	17.5	No	-	-	-	-	0.00
F,2	161	5.8	Yes	0.08	-	-	0.22	0.22
D,1	270	17.5	No	-	-	-	-	0.22
F,3	241	3.5	Yes	0.11	0.02	-	0.68	0.90
E,2	282	5.8	Yes	0.05	0.02	-	-	0.95
E,3	423	3.5	Yes	0.13	0.05	-	0.23	1.18
D,2	539	5.8	Yes	0.01	0.06	-	0.02	1.23
E,4	564	2.5	Yes	0.05	0.02	0.09	0.22	1.45
E,5	705	1.9	Yes	-	-	-	0.11	1.56
D,3	809	3.5	Yes	0.09	0.19	0.17	0.09	1.76
D,4	1,078	2.5	Yes	0.15	0.32	0.33	0.33	2.09
D,5	1,348	1.9	Yes	0.13	0.25	0.35	0.26	2.44
D,6	1,617	1.6	Yes	0.03	0.16	0.33	0.21	2.77
D,7	1,887	1.3	Yes	0.02	0.10	0.21	0.02	2.98
C,2	2,862	5.8	Yes	-	-	0.01	-	2.99
D,8	2,157	1.2	Yes	0.02	0.07	0.09	0.03	3.08
B,1	4,799	17.5	No	-	-	-	-	3.08
C,3	4,294	3.5	Yes	-	0.11	0.05	0.01	3.20
C,4	5,725	2.5	Yes	-	0.19	0.09	-	3.39
C,5	7,156	1.9	Yes	-	0.27	0.33	-	3.72
B,2	9,598	5.8	Yes	-	0.02	0.05	-	3.77
C,6	8,587	1.6	Yes	-	0.11	0.03	-	3.88
C,7	10,019	1.3	Yes	-	-	0.01	-	3.89
C,8	11,450	1.2	Yes	-	-	-	-	3.89
B,3	14,397	3.5	Yes	-	0.09	0.06	-	3.98
A,1	5,000	17.5	No	-	-	-	-	3.98
C,9	12,881	1.0	Yes	-	-	-	-	3.98
C,10	14,312	0.9	Yes	-	-	-	-	3.98
C,11	15,743	0.8	Yes	-	-	-	-	3.98
B,4	19,196	2.5	Yes	-	0.09	0.27	-	4.26
C,12	17,175	0.8	Yes	-	-	-	-	4.26
B,5	23,995	1.9	Yes	-	0.06	0.01	-	4.32
A,2	10,000	5.8	Yes	-	0.01	-	-	4.33

Visual Effects Screening Analysis for
Source: Elba Island LNG Terminal
Class I Area: HHA

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	60.40	TON/YR
NOx (as NO2)	980.00	TON/YR
Primary NO2	.00	TON/YR
Soot	.00	TON/YR
Primary SO4	.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	25.00 km
Source-Observer Distance:	31.40 km
Min. Source-Class I Distance:	31.40 km
Max. Source-Class I Distance:	32.40 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	5
Wind Speed:	3.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	31.4	84.	2.06	.402	.05	-.001
SKY	140.	84.	31.4	84.	2.00	.132	.05	-.002
TERRAIN	10.	84.	31.4	84.	2.00	.070	.05	.001
TERRAIN	140.	84.	31.4	84.	2.00	.023	.05	.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	29.3	104.	2.00	.408	.05	-.001
SKY	140.	65.	29.3	104.	2.00	.134	.05	-.002
TERRAIN	10.	50.	27.4	119.	2.00	.088	.05	.001
TERRAIN	140.	50.	27.4	119.	2.00	.029	.05	.001

Dispersion Condition	$\sigma_z \times \upsilon$ (m^2/s)	Transport Time (hr)	Include? (yes/no)	1984 Occurrence Frequency (%) 1-6 Freq	7-12 Freq	13-18 Freq	19-24 Freq	Worst-CaseCumulative Frequency (%) 0-24 Cum. Freq.
F,1	54	7.4	Yes	0.48	0.06	-	0.08	0.48
E,1	91	7.4	Yes	-	0.07	-	0.02	0.55
F,2	108	2.5	Yes	0.32	-	-	0.18	0.87
F,3	162	1.5	Yes	0.79	-	-	0.26	1.66
D,1	161	7.4	Yes	0.11	0.03	0.01	0.02	1.77
E,2	183	2.5	Yes	0.01	-	-	-	1.78
E,3	274	1.5	Yes	0.16	0.06	-	0.11	1.94
D,2	321	2.5	Yes	0.02	0.07	-	0.01	2.01
E,4	366	1.1	Yes	0.33	0.05	0.01	0.27	2.34
E,5	457	0.8	Yes	0.15	0.02	-	0.15	2.49
D,3	482	1.5	Yes	0.06	0.23	-	0.05	2.72
D,4	642	1.1	Yes	0.14	0.24	0.08	0.09	2.96
D,5	803	0.8	Yes	0.11	0.16	0.11	0.09	3.12
D,6	963	0.7	Yes	0.07	0.09	0.17	0.08	3.29
D,7	1,124	0.6	Yes	0.05	0.08	0.19	0.06	3.48
D,8	1,284	0.5	Yes	0.01	0.03	0.15	0.02	3.63
C,2	1,307	2.5	Yes	-	0.02	-	-	3.65
B,1	1,874	7.4	Yes	-	-	-	-	3.65
C,3	1,961	1.5	Yes	-	0.06	0.05	-	3.71
C,4	2,615	1.1	Yes	-	0.13	0.07	-	3.84
C,5	3,268	0.8	Yes	-	0.23	0.24	-	4.08
B,2	3,749	2.5	Yes	-	0.06	-	-	4.13
C,6	3,922	0.7	Yes	-	0.15	0.08	-	4.28
C,7	4,575	0.6	Yes	-	-	0.01	-	4.29
A,1	5,000	7.4	Yes	-	-	-	-	4.29
C,8	5,229	0.5	Yes	-	-	-	-	4.29
B,3	5,623	1.5	Yes	-	0.07	0.08	-	4.37
C,9	5,883	0.4	Yes	-	-	-	-	4.37
C,10	6,536	0.4	Yes	-	-	-	-	4.37
C,11	7,190	0.4	Yes	-	-	-	-	4.37
B,4	7,498	1.1	Yes	-	0.10	0.11	-	4.49
C,12	7,844	0.3	Yes	-	-	-	-	4.49
B,5	9,372	0.8	Yes	-	0.06	0.03	-	4.54
A,2	10,000	2.5	Yes	-	-	-	-	4.54

Visual Effects Screening Analysis for
Source: Elba Island LNG Terminal
Class I Area: SHAA

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	60.40	TON/YR
NOx (as NO2)	980.00	TON/YR
Primary NO2	.00	TON/YR
Soot	.00	TON/YR
Primary SO4	.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone: .04 ppm
Background Visual Range: 25.00 km
Source-Observer Distance: 13.30 km
Min. Source-Class I Distance: 13.30 km
Max. Source-Class I Distance: 14.30 km
Plume-Source-Observer Angle: 11.25 degrees
Stability: 4
Wind Speed: 1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	105.	14.3	64.	5.13	2.085	.08	-.004
SKY	140.	105.	14.3	64.	2.00	.695	.08	-.008
TERRAIN	10.	84.	13.3	84.	4.51	.654	.09	.005
TERRAIN	140.	84.	13.3	84.	2.00	.207	.09	.003

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	10.	6.4	159.	2.00	2.985*	.05	-.008
SKY	140.	10.	6.4	159.	2.00	.967	.05	-.016
TERRAIN	10.	5.	4.1	164.	2.00	1.677	.05	.016
TERRAIN	140.	5.	4.1	164.	2.00	.559	.05	.014

Dispersion Condition	$\sigma_z \times \upsilon$ (m^2/s)	Transport Time (hr)	Include? (yes/no)	1984 Occurrence Frequency (%) 1-6 Freq	7-12 Freq	13-18 Freq	19-24 Freq	Worst-CaseCumulative Frequency (%) 0-24 Cum. Freq.
F,1	63	10.5	Yes	0.46	0.05	-	0.33	0.46
E,1	109	10.5	Yes	0.02	0.01	0.02	0.02	0.48
F,2	127	3.5	Yes	0.26	0.01	-	0.07	0.74
F,3	190	2.1	Yes	0.39	0.03	-	0.14	1.13
D,1	198	10.5	Yes	0.02	0.02	-	0.01	1.15
E,2	218	3.5	Yes	-	0.02	0.02	0.01	1.18
E,3	327	2.1	Yes	0.08	0.11	0.01	0.10	1.29
D,2	396	3.5	Yes	0.01	0.02	0.02	0.01	1.31
E,4	436	1.5	Yes	0.25	-	0.03	0.13	1.56
E,5	545	1.2	Yes	0.15	0.01	0.02	0.13	1.71
D,3	594	2.1	Yes	0.09	0.16	0.15	0.02	1.87
D,4	792	1.5	Yes	0.11	0.16	0.19	0.06	2.07
D,5	990	1.2	Yes	0.03	0.10	0.13	0.05	2.19
D,6	1,188	1.0	Yes	0.09	0.13	0.23	0.06	2.42
D,7	1,387	0.8	Yes	0.08	0.21	0.25	0.06	2.67
D,8	1,585	0.7	Yes	0.06	0.10	0.27	0.10	2.95
C,2	1,796	3.5	Yes	-	0.03	0.01	0.01	2.98
C,3	2,694	2.1	Yes	-	0.14	0.09	-	3.12
B,1	2,744	10.5	Yes	-	0.01	0.01	-	3.13
C,4	3,592	1.5	Yes	-	0.19	0.10	-	3.32
C,5	4,491	1.2	Yes	-	0.13	0.15	-	3.47
A,1	5,000	10.5	Yes	-	-	-	-	3.47
C,6	5,389	1.0	Yes	-	0.05	0.13	-	3.60
B,2	5,488	3.5	Yes	-	0.02	0.01	-	3.62
C,7	6,287	0.8	Yes	-	0.03	0.01	-	3.65
C,8	7,185	0.7	Yes	-	-	0.01	-	3.66
C,9	8,083	0.6	Yes	-	0.01	-	-	3.68
B,3	8,233	2.1	Yes	-	0.11	0.02	-	3.79
C,10	8,981	0.6	Yes	-	-	-	-	3.79
C,11	9,879	0.5	Yes	-	-	-	-	3.79
A,2	10,000	3.5	Yes	-	0.01	0.01	-	3.80
C,12	10,777	0.5	Yes	-	-	-	-	3.80
B,4	10,977	1.5	Yes	-	0.07	0.10	-	3.90
B,5	13,721	1.2	Yes	-	0.05	0.07	-	3.97

Visual Effects Screening Analysis for
Source: Elba Island LNG Terminal
Class I Area: SIA

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	60.40	TON/YR
NOx (as NO2)	980.00	TON/YR
Primary NO2	.00	TON/YR
Soot	.00	TON/YR
Primary SO4	.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone: .04 ppm
Background Visual Range: 25.00 km
Source-Observer Distance: 18.90 km
Min. Source-Class I Distance: 18.90 km
Max. Source-Class I Distance: 19.90 km
Plume-Source-Observer Angle: 11.25 degrees
Stability: 6
Wind Speed: 3.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	18.9	84.	2.00	1.475	.05	-.003
SKY	140.	84.	18.9	84.	2.00	.490	.05	-.006
TERRAIN	10.	84.	18.9	84.	2.00	.394	.05	.003
TERRAIN	140.	84.	18.9	84.	2.00	.129	.05	.002

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	35.	15.0	134.	2.00	1.609	.05	-.004
SKY	140.	35.	15.0	134.	2.00	.530	.05	-.007
TERRAIN	10.	25.	13.5	144.	2.00	.548	.05	.004
TERRAIN	140.	25.	13.5	144.	2.00	.183	.05	.004

Dispersion Condition	$\sigma_z \times \upsilon$ (m^2/s)	Transport Time (hr)	Include? (yes/no)	1984 Occurrence Frequency (%) 1-6 Freq	7-12 Freq	13-18 Freq	19-24 Freq	Worst-CaseCumulative Frequency (%) 0-24 Cum. Freq.
F,1	55	7.7	Yes	0.83	0.07	-	0.26	0.83
E,1	93	7.7	Yes	0.03	0.06	-	-	0.89
F,2	110	2.6	Yes	0.34	-	-	0.17	1.23
F,3	165	1.5	Yes	0.58	0.01	-	0.53	1.82
D,1	164	7.7	Yes	0.01	0.03	0.01	-	1.85
E,2	186	2.6	Yes	0.05	-	0.01	0.02	1.89
E,3	280	1.5	Yes	0.17	0.10	0.03	0.21	2.10
D,2	328	2.6	Yes	0.03	0.01	-	-	2.13
E,4	373	1.1	Yes	0.21	0.01	-	0.10	2.34
E,5	466	0.9	Yes	0.08	-	-	0.07	2.42
D,3	493	1.5	Yes	0.11	0.19	0.07	0.08	2.61
D,4	657	1.1	Yes	0.15	0.18	0.07	0.05	2.80
D,5	821	0.9	Yes	0.05	0.02	0.11	0.02	2.91
D,6	985	0.7	Yes	0.03	0.10	0.06	0.02	3.01
D,7	1,149	0.6	Yes	0.02	0.05	0.01	0.02	3.06
D,8	1,314	0.5	Yes	-	0.01	0.03	0.02	3.09
C,2	1,353	2.6	Yes	-	0.08	0.02	-	3.17
B,1	1,953	7.7	Yes	-	0.02	-	-	3.20
C,3	2,029	1.5	Yes	-	0.11	0.03	-	3.31
C,4	2,705	1.1	Yes	-	0.14	0.09	-	3.45
C,5	3,382	0.9	Yes	-	0.09	0.11	-	3.56
B,2	3,906	2.6	Yes	-	0.02	0.03	-	3.60
C,6	4,058	0.7	Yes	-	0.03	0.08	-	3.68
C,7	4,735	0.6	Yes	-	-	-	-	3.68
A,1	5,000	7.7	Yes	-	0.02	0.01	-	3.70
C,8	5,411	0.5	Yes	-	-	-	-	3.70
B,3	5,859	1.5	Yes	-	0.07	0.07	-	3.77
C,9	6,087	0.5	Yes	-	-	-	-	3.77
C,10	6,764	0.4	Yes	-	-	-	-	3.77
C,11	7,440	0.4	Yes	-	-	-	-	3.77
B,4	7,812	1.1	Yes	-	0.14	0.09	-	3.90
C,12	8,116	0.3	Yes	-	-	-	-	3.90
B,5	9,765	0.9	Yes	-	0.02	0.08	-	3.98
A,2	10,000	2.6	Yes	-	0.03	-	-	4.02

Visual Effects Screening Analysis for
Source: Elba Island LNG Terminal
Class I Area: SISP

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	60.40	TON/YR
NOx (as NO2)	980.00	TON/YR
Primary NO2	.00	TON/YR
Soot	.00	TON/YR
Primary SO4	.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	25.00 km
Source-Observer Distance:	13.80 km
Min. Source-Class I Distance:	13.80 km
Max. Source-Class I Distance:	14.80 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	3.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	104.	14.8	65.	2.00	2.068*	.05	-.004
SKY	140.	104.	14.8	65.	2.00	.690	.05	-.008
TERRAIN	10.	84.	13.8	84.	2.00	.634	.05	.004
TERRAIN	140.	84.	13.8	84.	2.00	.202	.05	.003

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	20.	9.1	149.	2.00	2.619*	.05	-.006
SKY	140.	20.	9.1	149.	2.00	.862	.05	-.012
TERRAIN	10.	5.	4.3	164.	2.00	1.342	.05	.013
TERRAIN	140.	5.	4.3	164.	2.00	.447	.05	.012

Dispersion Condition	$\sigma_z \times \upsilon$ (m^2/s)	Transport Time (hr)	Include? (yes/no)	Maximum Year of Fire Years = 1984 1-6	7-12	13-18	19-24	Worst-Case Cumulative Frequency 0-24 (%)
				Occurrence Frequency (%)				
F,1	50	6.4	Yes	0.82	0.08	-	0.25	0.82
E,1	85	6.4	Yes	0.03	0.06	-	-	0.88
F,2	101	2.1	Yes	0.35	-	-	0.16	1.23
D,1	147	6.4	Yes	0.02	0.02	0.01	-	1.26
F,3	151	1.3	Yes	0.62	0.01	-	0.47	1.87
E,2	170	2.1	Yes	0.05	-	0.01	0.02	1.92
E,3	255	1.3	Yes	0.19	0.10	0.02	0.17	2.11
D,2	294	2.1	Yes	0.02	0.01	0.01	-	2.13
E,4	339	0.9	Yes	0.22	0.01	-	0.08	2.35
E,5	424	0.7	Yes	0.05	-	-	0.07	2.42
D,3	440	1.3	Yes	0.10	0.22	0.08	0.08	2.64
D,4	587	0.9	Yes	0.11	0.16	0.07	0.06	2.80
D,5	734	0.7	Yes	0.07	0.03	0.06	0.03	2.87
D,6	881	0.6	Yes	0.01	0.08	0.02	0.02	2.95
D,7	1,027	0.5	Yes	0.02	0.05	0.05	0.02	2.99
C,2	1,142	2.1	Yes	-	0.07	0.03	0.01	3.06
D,8	1,174	0.4	Yes	0.01	0.01	0.05	0.02	3.11
B,1	1,593	6.4	Yes	-	0.02	-	-	3.13
C,3	1,712	1.3	Yes	-	0.10	0.03	-	3.23
C,4	2,283	0.9	Yes	-	0.15	0.09	-	3.38
C,5	2,854	0.7	Yes	-	0.08	0.10	-	3.48
B,2	3,187	2.1	Yes	-	0.02	0.03	-	3.52
C,6	3,425	0.6	Yes	-	0.03	0.09	-	3.61
C,7	3,996	0.5	Yes	-	-	-	-	3.61
C,8	4,567	0.4	Yes	-	-	-	-	3.61
B,3	4,780	1.3	Yes	-	0.08	0.08	-	3.69
A,1	5,000	6.4	Yes	-	0.02	0.01	-	3.71
C,9	5,137	0.4	Yes	-	-	-	-	3.71
C,10	5,708	0.3	Yes	-	-	-	-	3.71
C,11	6,279	0.3	Yes	-	-	-	-	3.71
B,4	6,373	0.9	Yes	-	0.15	0.08	-	3.86
C,12	6,850	0.3	Yes	-	-	-	-	3.86
B,5	7,967	0.7	Yes	-	0.03	0.09	-	3.95
A,2	10,000	2.1	Yes	-	0.02	-	-	3.97

Visual Effects Screening Analysis for
Source: Elba Island LNG Terminal
Class I Area: WHS

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	60.40	TON/YR
NOx (as NO2)	980.00	TON/YR
Primary NO2	.00	TON/YR
Soot	.00	TON/YR
Primary SO4	.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	25.00 km
Source-Observer Distance:	11.50 km
Min. Source-Class I Distance:	11.50 km
Max. Source-Class I Distance:	12.50 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	4
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	107.	12.5	61.	5.35	2.469	.09	-.005
SKY	140.	107.	12.5	61.	2.00	.825	.09	-.009
TERRAIN	10.	84.	11.5	84.	4.63	.804	.09	.005
TERRAIN	140.	84.	11.5	84.	2.00	.250	.09	.003

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	10.	5.5	159.	2.00	4.000*	.05	-.011
SKY	140.	10.	5.5	159.	2.00	1.303	.05	-.020
TERRAIN	10.	5.	3.6	164.	2.00	2.093*	.05	.019
TERRAIN	140.	5.	3.6	164.	2.00	.699	.05	.017